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STATE OF NEVADA

THIRD

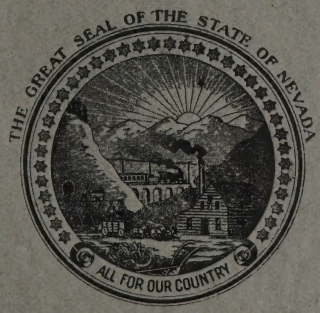
BIENNIAL REPORT

OF THE

DEPARTMENT OF HIGHWAYS

PART 1

1921 -- 1922



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STATE OF NEVADA

THIRD

BIENNIAL REPORT

OF THE

DEPARTMENT OF HIGHWAYS

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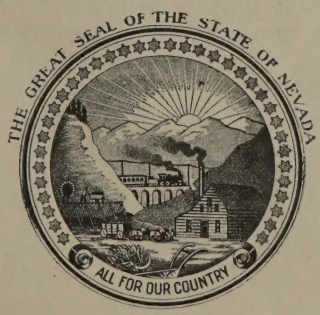
PART I

1921 -- 1922



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Letter of Transmittal

STATE OF NEVADA
DEPARTMENT OF HIGHWAYS
CARSON CITY

January, 1, 1923.

To The HONORABLE JAMES G. SCRUGHAM,
Governor of the State of Nevada.

Dear Sir:

The undersigned, Directors of the Department of Highways, appointed and acting under the provisions of the Nevada State Highway Law, herewith submit their third report, for the biennial period December 1, 1920 to November 30, 1922.

In this report we have endeavored to set forth briefly the accomplishments of the Department in the construction of the State Highway System.

During this biennial period the amended Federal Highway Law was passed, which provides for the graduated scale of Federal Aid to the public land states, and we feel that it may now be said that State highway construction in Nevada is safely financed for some time in the future and the work should go forward uninterruptedly during the next few years.

To Ex-Governor Emmet D. Boyle, under whose administration the work was carried on from the time of organization of the Department to the present date, we wish to express our sincere appreciation for his counsel and guidance during the most critical period of the Department's existence, and who so largely contributed to such measure of success as has been attained.

We wish to express to the other state officers our sincere appreciation of their hearty co-operation during the past two years, and to also take this opportunity of expressing our appreciation and commendation of all the employees of the Department, who, by their perseverance, loyalty and support during the biennium have made the work of the Department a success.

JAMES M. LEONARD, Chairman.
W. H. JOHNSTON, Director.
GEO. A. CAMPBELL, Director.

Personnel of Department of Highways

ADMINISTRATION

JAMES M. LEONARD	Chairman of Board of Directors
W. H. JOHNSTON	Director
GEO. A. CAMPBELL	Director
GEO. W. BORDEN	State Highway Engineer
HOWARD M. LOY	Assistant State Highway Engineer
FLOYD O. BOOE	Auditor and Secretary to the Board

DEPARTMENT AND DIVISION HEADS

H. F. HOLLEY	Engineer of Surveys and Designs
C. C. BOYER	Division Engineer, Division I
E. T. HINSHAW	Division Engineer, Division II
S. C. DURKEE	Division Engineer, Division III
P. L. BONEYSTEELE	Maintenance Engineer
T. J. COLLINS	Superintendent of Equipment
J. M. KANE	Chief Draftsman
W. T. HOLCOMB	Testing Engineer

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The Transformation Of Byways Into Highways

A Report of Progress

By GEORGE W. BORDEN
State Highway Engineer

REPORT OF THE DEPARTMENT OF HIGHWAYS

INTRODUCTORY

The biennium period 1921-1922 has been one of great accomplishment for the Nevada State Department of Highways. With the passage of the Act of Congress which permitted the application of Federal Aid on the basis of publicly owned lands in the several states and by the adoption of the policy by this Department of delaying the completion of many projects until the passage of that Act, we were enabled to put on a program during this period that resulted in the completion of highways that equalled all previous activities.

Prior to November 30, 1920, thirty-seven (37) contracts were awarded for highway and bridge construction, comprising 205.38 miles of highways and 1714 lin. ft. of bridges of more than twenty foot clear span, all of which involved a cost of $2,499,432.22 for contractor's payments and materials.

During the biennium 1921 and 1922, thirty-one (31) contracts were awarded and three (3) projects for construction by Day Labor Forces were authorized, which permitted the construction of 262.03 miles of highways and 434 lin. ft. of bridges of more than twenty foot clear span, all of which involved the expenditure of $2,493,732.36 for contractor's payments, labor and materials.

The work during the year 1922 was performed under the administration of the present organization of this department. Early in the year each department was carefully organized and budgeted for a given program and instructions given that each must, if possible, stay within the limits of its budget. We are proud to state that the several departments were able to stay well within their budget allowances, the only exceptions being in the case of some of the departments which were ordered to increase their activities owing to the enlarged program made possible by the contracting of the work on the various projects at a lower figure than was estimated for the budget which was based on 1921 prices.

The organizations affected by the order to increase expenditures were the Departments of Surveys and Maintenance, the first in order to prepare more projects for contracts and the second to maintain more completed work. The two increases resulted in a natural increase of the administrative cost, the details of which are shown in Table No. 10 of the appendix. As will be noted in this tabulation there has been such a marked saving in several departments over the budget estimate that with a total budget amount of $237,797.31, for non-participating accounts, and an actual expenditure of $255,408.77, the total excess expenditure is but $17,611.46.

Too much credit cannot be given to C. C. Cottrell, former State Highway Engineer, for his achievement in so mapping out the program for 1921 that the program for 1922 could be carried through, and for his energetic support of the graduated scale of Federal Aid for the Public Land States, both at home and at Washington, D. C.

We also wish to express our appreciation of the very commendable manner in which the Department of Agriculture, through its Bureau of Public Roads, co-operated with and assisted us in our program of highway construction under the new Federal Aid Act, and we particularly wish to mention C. H. Sweetser, District Engineer, Division 2, Bureau of Public Roads of San Francisco, California, and to extend to him our thanks for the very able and efficient assistance that he and his men rendered to us in overcoming the many obstacles which were preventing the full enjoyment by this State of the new graduated scale of Federal Aid.

Our construction activities for the future are now placed on a strong financial basis. The wise enactments of past legislatures coupled with the late Federal Aid Act will assure us of a systematic progress in highway development that will last as long as the Federal Government extends its aid.

The question of maintenance, however, is getting to be a very serious one. For that reason we take the liberty of calling attention to the gasoline tax in this report, with a hope that the income from such a tax, together with a part or all of the fees collected through motor vehicle licenses, will be sufficient to answer the maintenance question until future Federal legislation may arrange for an equitable participation by the Federal Government.

We have endeavored in the following chapters, to set forth a brief report of each of the various activities of the Department and we trust that the information therein contained will be instructive and of interest to those who are interested in highway improvement in this State.

LEGISLATIVE RECOMMENDATIONS

In view of past activities of this Department and its advantageous position to secure statewide information regarding the State's needs, we feel that we should call to your attention at this time certain new legislative matters which very materially affect further highway improvement.

1. Three new State highways should be added to our State highway system:

(a) Extension of the Winnemucca North road from Paradise Hill to McDermitt on the Oregon line to develop the Idaho-Oregon-Nevada Cutoff.

(b) Designation of a route from Wells northward to a connection with Twin Falls, Idaho, in order to secure an interstate highway route into the State of Idaho. This route now carries a large amount of interstate traffic between Idaho points and Southern California.

(c) The route from Virginia City to the junction with the Carson-Dayton road near Mound House.

These highways probably could not all receive Federal aid at once, but they should be placed in position for active construction should funds become available.

2. A two-cent gasoline tax to be used for maintenance and reconstruction, thus placing the burden of the repair of our highways upon the user regardless of where his citizenship may be.

3. The increase of our schedule of motor vehicle license fees so that it will be on an equality with that of the surrounding states.

4. That commercial vehicles using the highway for hire and under the jurisdiction of the Public Service Commisson, pay a percentage of their gross receipts so that they will be placed more directly in competition with other common carriers.

5. That the maximum gross weight per vehicle be not to exceed 22,000 pounds when carried on four wheels, and not to exceed 30,000 pounds when carried on six wheels. That a maximum load of 600 pounds per inch of width of tire be the limit for any vehicle with a tire made of material other than metal and that a maximum load of 450 pounds per inch of width of tire be the limit for any vehicle equipped with tires made in whole or in part with a metal bearing surface coming in contact with the highway.

6. That the maximum width of any vehicle shall not be more than 102 inches and that the luggage, crate, box or other load placed on any pleasure type automobile shall not extend to the left beyond the body of the car more than 12 inches.

7. That the maximum speed limit for the State be not to exceed 35 miles per hour.

8. That the State highway maintenance men be authorized to act in conjunction with the State police in the enforcement of the provisions of the Motor Vehicle Act.

9. That the remaining funds of the motor vehicle license money which are not needed for bond redemption and interest for each current year be placed in the State Highway Fund.

10. That the age limit for operators of cars be increased from sixteen to eighteen years and that the restriction be made applicable to the entire State.

The State As A Road Builder

A Survey of Finances both Federal and State in Their Relation to Highway Development in Nevada

By FLOYD O. BOOE
Auditor

FEDERAL AID IN HIGHWAY CONSTRUCTION

The original Federal Aid Road Act became a law in 1916 and under its provisions there was extended to the states in the form of cooperative aid certain funds allotted to the states on an equitable basis, the actual expenditure of the funds being surrounded by certain rules and regulations which each state was required to meet. Since the passage of the original act, many amendments have been made by succeeding sessions of Congress, the last of such being an almost complete revision of the law into the act known as the Federal Highway Act, which act combined many of the general principles of the Townsend plan of national highways with those of Federal Aid extended to the states in a manner similar to that provided in all previous acts.

HISTORICAL OUTLINE

Perhaps in a general discussion of the subject of Federal Aid in highway building a short review of the history of this form of legislation is not amiss. Paternalism, in the Federal government is, as a usual thing, very undesirable, and the greater the degree in which general legislation tends in this direction, by just such a degree will the independent, self-reliant government of the individual states be weakened and destroyed. It may be said, however, that there are certain conditions under which the encouragement of the general government, either financial or otherwise, becomes necessary to foster and promote some general principle which applies to the upbuilding, betterment and protection of the nation. We feel it may be truly said that this broad principle does apply to the matter of highway improvement in the United States. Looking back over the transportation history of the country, we find what? First, that in Colonial times the Indian game trail supplemented by the canoe on the rivers and lakes met the transportation needs of the settlers, hunters and trappers east of the Alleghanies. Following the Revolution the eyes of the colonists turned westward in response to the tales of the wonderful wilderness country brought back by the hardy adventurers who had penetrated the western country. Followed a general westward migration from the north to the south end of the thirteen colonies. The westward trail gradually became a widened roadway over which the pioneer moved his wagons containing his family and worldly goods. The government became interested and encouraged this western movement by authorizing the building of the National Pike over the mountains leading to the wilderness country. At this time road building became of great importance and wonderful progress was made in opening roads into the new country. Almost in the midst of the development, however, Robert Fulton, through the Claremont, on the Hudson, proved the possibilities of steam, and about the same time Stevenson perfected his steam locomotive. Immediately, the building of railroads westward began and the country entered into

the great railroad era which extended down almost to the present day. With the exception of a few of the eastern states, road building was relegated to the background, and there it remained until the time of real development of the motor vehicle, along about 1910. The growth in popularity of the automobile, however, set the average citizen to thinking on the matter of road improvement. It was no pleasure to take that shiny new car out and attempt to negotiate the average rutted path serving as a road. Hardly had this been realized, when Mr. Average Citizen found that the motor car had gradually become almost indispensable to him in his business and professional life, and then he began to look at the matter of highway improvement from the economic standpoint. There developed a growing and insistent demand throughout the country for better road conditions. The Federal government had made some provision for a guiding hand through the establishment of a special bureau of rural road engineering in the Department of Agriculture. From 1910 to 1916 we see rapid increase in the number and use of trucks and autos, with a slow increase in the mileage of improved roads. Statistics since gathered show the comparative conditions of motor vehicle and road investment during this period to have been as follows:

1910—Road construction	$ 95,000,000.00
1910—Motor vehicle investment	386,250,000.00
1910 to 1916—Road construction	1,056,000.000.00
1916—Motor vehicle investment	2,822,250,000.00

From 1916 to date the increase in motor vehicle investment has been enormous, with a consequent further lagging behind of highway improvement, the figures at the end of 1920 being as follows:

1910 to 1921—Road construction	$2,526,000,000.00
1921—Motor vehicle investment	$8,322,000,000.00

THE FEDERAL AID ROAD ACT AND AMENDMENTS

The Act of 1916 carried an appropriation of $75,000,000.00 to be apportioned under certain conditions to all the states. The important object of the Act, however, was to establish and encourage two general principles. First, compel the establishment of a proper centralized state authority to handle state highway improvement, usually represented in the form of a State Highway Department, and second, to make the beginning of a system of connected interstate highways serving both local and national needs. Time has demonstrated the foresightedness of the framers of the original Act through its successful application during the past six years, and has served to so firmly fix the two foregoing principles that there can be no radical departure from these principles until some better and more feasible plans are advanced and proven. In the application of the first Act many obstacles had to be overcome, and of course many mistakes were made, but that the general principle was correct has been proven beyond any shadow of doubt.

Specific provisions of the Act as first enacted and which had to be met by each state desiring to participate in Federal Aid were partly as follows:

1.—The Government will participate in road construction only through a duly organized and existing State Highway Department.

2.—All administration expense must be borne by the State.

3.—Federal aid will be granted only for those projects included within a definite and comprehensive highway system, which so far, in this State, consists of our State Highway System as laid out by legislative Acts.

It is specified that the Government will not participate in any improvement in an amount of money greater than 50 per cent of the cost of construction and that the maximum allotment will be $20,000 per mile, exclusive of bridges over 20-foot span.

5.—Only projects substantial in character and proposed to be improved in accordance with approved plans and specifications will be considered. The State, on its own behalf, and without financial assistance from the Federal Government, is required to make all necessary surveys, plans, specifications, and estimates.

6.—Rights of way shall be provided by or on behalf of the State and damages to adjoining property paid for by the State. The Government will not participate in this expense.

7.—The method of making surveys, plans, specifications, and estimates, and the doing of the work itself, must be in accordance, generally speaking, with well-defined rules and regulations of the Federal Government.

8.—Every item of the work, from the preliminary location to its final completion, including the awarding of the contracts, the testing of materials, and every other matter, is under the direct supervision of the federal authorities.

As will be noted from the foregoing the Federal Aid was to meet. not to exceed 50 per cent of the cost of construction of the project, provided the total cost did not exceed $40,000.00 per mile—exclusive of bridges over 20-foot clear span which are always handled as separate projects. In actual practice it was found that a much smaller percentage of costs was being borne by the Federal Government. This was because the Government did not share at all in the surveys, plans and right of way costs, nor in any of the costs that are termed as overhead. This led this Department to begin the advocation, as far back as 1918, of some amendment of the Federal Aid Road Act that would give to the states with sparse population and large areas of public non-taxable land a more equitable ratio of cooperation than the theoretical 50-50 provided in the original Act.

THE PRINCIPLE OF THE GRADUATED SCALE

The original idea of a balancing factor to be introduced into the Federal law to in some manner offset the great handicap of the western states with their large areas of public land and sparse population was first presented by C. C. Cottrell, former State Highway Engineer of Nevada. The first thought on the subject was that some two or three factors might be introduced in the same manner in which the funds are allotted to the state, but finally after much thought and careful compilation of a large amount of data it was

decided that the fairest and most equitable ratio would be that of public land to privately owned taxable land within each state. Preliminary figures demonstrated that by the application of this rule the pro rata of Federal cooperation on projects would be increased almost in proportion to the population and highway needs of the various states. For the lack of a more descriptive term the theory was called the "Graduated Scale of Federal Aid."

Four years of constant, unremitting effort on the part of all the western states was necessary before the desired Congressional Amendment was made. The clause was finally incorporated in the passage of the original Phipps-Dowell Bill, amended and arranged in the form of the Federal Highway Act approved on November 9. 1921. Under the Federal Highway Act the ratio of cooperation between the Federal Government and the various public land states was found to be approximately as follows:

FEDERAL AID ROAD WORK
PUBLIC LAND STATES DATA

June 15, 1922.

STATE.	Ratio of area of unappropriated land to total area.	Percentage payable by United States.	Maximum Federal Aid payment per mile of highway. Act of Nov. 9, 1921.	Maximum Federal Aid payment per mile of highway. $16,500 Basis A.	Maximum Federal Aid payment per mile of highway. $15,000 Basis B. Approximate.
Arizona	0.222254	61.11272	$24,445.09	$20,167.20	$18,333.82
California	0.186393	59.31968	23,727.87	19,575.49	17,795.90
Colorado	0.122511	56.12556	22,450.22	18,521.43	16,837.67
Idaho	0.160301	58.01506	23,206.02	19,144.97	17,404.52
Montana	0.060802	53.04009	21,216.04	17,503.23	15,912.03
Nevada	0.744516	87.22580	34,890.32	28,784.51	26,167.74
New Mexico	0.230156	61.50782	24,603.13	20,297.58	18,452.35
Oregon	0.222734	61.13673	24,454.69	20,175.12	18,341.02
Utah	0.497084	74.85420	29,941.68	24,701.89	22,456.26
Wyoming	0.293080	64.65402	25,861.61	21,335.83	19,396.21

A—Amounts in this column may be changed July 1st.
B—Amounts in this column are approximate only, and may be changed later, with changes at end of fiscal year in ratio of unappropriated land.

The "Graduated Scale" clause as written into the Federal Highway Act is as follows:

> "* * * except that in the case of any State containing unappropriated public lands exceeding 5 per centum of the total area of all lands in the State, the share of the United States payable under this Act on account of such projects shall not exceed 50 per centum of the total estimated cost thereof plus a percentage of such estimated cost equal to one-half of the percentage which the area of the unappropriated public lands in such State bears to the total area, of such State; Provided, that the limitation of payments not to exceed $20,000 per mile, under existing law, which the Secretary of Agriculture may make be, and the same is hereby, increased in proportion to the increased percentage of Federal aid authorized

by this section; Provided further, that these provisions relative to the public land states shall apply to all unobligated or unmatched funds appropriated by the Federal Aid Act and payment for approved projects upon which actual building construction work had not begun on the 30th day of June, 1921."

OTHER PROVISIONS OF THE FEDERAL HIGHWAY ACT THE FEDERAL AID SEVEN PER CENT SYSTEM

The Federal Highway Act as passed, to a very large extent, represented a compromise between the advocates of the Townsend or national highway plan, and the advocates of continued cooperative Federal Aid under the original plan. The really important feature of the bill in this respect, is that portion providing for the seven per cent Federal Aid highway system which is set forth in section 6, as follows:

Section 6.—That in approving projects to receive Federal aid under the provisions of this Act the Secretary of Agriculture shall give preference to such projects as will expedite the completion of an adequate and connected system of highways, interstate in character.

Before any projects are approved in any State, such State, through its State highway department, shall select or designate a system of highways not to exceed 7 per centum of the total highway mileage of such State as shown by the records of the State highway department at the time of the passage of this Act.

Upon this system all Federal-aid apportionments shall be expended.

Highways which may receive Federal-aid shall be divided into two classes, one of which shall be known as primary or interstate highways, and shall not exceed three-sevenths of the total mileage which may receive Federal aid, and the other which shall connect or correlate therewith and be known as secondary or intercounty highways, and shall consist of the remainder of the mileage which may receive Federal Aid.

The Secretary of Agriculture shall have authority to approve in whole or in part the systems as designated or to require modifications or revisions thereof: PROVIDED, That the States shall submit to the Secretary of Agriculture for his approval any proposed revisions of the designated systems of highways above provided for.

Not more than 60 per centum of all Federal aid allotted to any State shall be expended upon the primary or interstate highways until provision has been made for the improvement of the entire system of such highways: PROVIDED, That with the approval of any State highway department the Secretary of Agriculture may approve the expenditure of more than 60 per centum of the Federal aid apportioned to such State upon the primary or interstate highways in such state.

The Secretary of Agriculture may approve projects submitted by the State highway departments prior to the selection, designation, and approval of the system of Federal-aid highways herein provided for if he may reasonably anticipate that such projects will become a part of such system.

Whenever provision has been made by any State for the completion and maintenance of a system of primary or interstate and secondary or intercounty highways equal to 7 per centum of the total mileage of such State, as required by this Act, said State, through its State highway department, by and with the approval of the Secretary of Agriculture, is hereby authorized to add to the mileage of primary or interstate and secondary or intercounty systems as funds become available for the construction and maintenance of such additional mileage.

MAINTENANCE OF THE FEDERAL HIGHWAY SYSTEM

No State can neglect the proper maintenance of the highways after construction under Federal aid, the law providing the following in this respect:

Section 14.—That should any State fail to maintain any highway within its boundaries after construction or reconstruction under the provisions of this Act, the Secretary of Agriculture shall then serve notice upon the State highway department of that fact, and if within ninety days after receipt of such notice said highway has not been placed in proper condition of maintenance, the Secretary of Agriculture shall proceed immediately to have such highway placed in a proper condition of maintenance and charge the cost thereof against the Federal funds allotted to such State, and shall refuse to approve any other project in such State, except as hereinafter provided.

Upon the reimbursement by the State of the amount expended by the Federal Government for such maintenance, said amount shall be paid into the Federal highway fund for reapportionment among all the States for the construction of roads under this Act, and the Secretary of Agriculture shall then approve further projects submitted by the State as in this Act provided.

FOREST HIGHWAYS AND FOREST ROADS AND TRAILS

Separate and distinct from the Seven Percent Federal Aid Highway system the Act also makes provision for a system of Forest Highways and Forest Roads and Trails, carrying the necessary appropriation to carry out the work.

Forest Highways are defined in the Act as those "of primary importance to the State, counties or communities within, adjoining, or adjacent to the National Forests." These highways may, or may not be a portion of the Seven Percent Federal Aid Highway System.

Provisions for the Forest Highway and Forest Road and Trail systems are made in Section 23 of the bill as follows:

Section 23.—That out of the moneys in the Treasury not otherwise appropriated, there is hereby appropriated for the survey, construction, reconstruction, and maintenance of forest roads and trails, the sum of $5,000,000 for the fiscal year ending June 30, 1922, available immediately and until expended, and $10,000,000 for the fiscal year ending June 30, 1923, available until expended.

(a) Fifty per centum, but not to exceed $3,000,000 for any one fiscal year, of the appropriation made or that may hereafter be made for expenditure under the provisions of this section shall be expended under the direct supervision of the Secretary of Agriculture in the

survey, construction, reconstruction, and maintenance of roads and trails of primary importance for the protection, administration, and utilization of the national forests, or when necessary, for the use and development of the resources upon which communities within or adjacent to the national forests are dependent, and shall be apportioned among the several States, Alaska and Porto Rico by the Secretary of Agriculture, according to the relative needs of the various national forests, taking into consideration the existing transportation facilities, value of timber, or other resources served, relative fire danger, and comparative difficulties of road and trail construction.

The balance of such appropriations shall be expended by the Secretary of Agriculture in the survey, construction, reconstruction, and maintenance of forest roads of primary importance to the State, counties, or communities within, adjoining, or adjacent to the national forests, and shall be prorated and apportioned by the Secretary of Agriculture for expenditures in the several States, Alaska, and Porto Rico, according to the area and value of the land owned by the Government within the national forests therein as determined by the Secretary of Agriculture from such information, investigation, sources, and departments as the Secretary of Agriculture may deem most accurate.

ALLOTMENTS UNDER THE FEDERAL AID ROAD ACT

In table No. Fifteen of this report is shown the total allotment of Federal Aid and Forest funds to the State of Nevada together with the amounts that have been collected to date.

In table No. Sixteen is shown the present status of all projects so far submitted under the act, and Plate One is a map showing the Seven Percent Federal Aid highway system as designated by the State and submitted to the Secretary of Agriculture for his approval.

SELECTING THE SEVEN PERCENT SYSTEM

After the passage of the Federal Highway Act of 1921 one of the first duties of the State Highway Department in order to take advantage of the full provisions of the Act was to select the seven percent Federal aid system on which Federal funds could be expended. This meant the selection of the designated State Highway System wherever possible. The preliminary step to the designations of the system was a determination of the total road mileage of the State, the seven percent system to represent, not to exceed, seven percent of such total mileage. For the purpose of such selections the total road mileage of the state was estimated at 22,000 miles, thus giving a total system mileage of 1,540 miles. While the Federal Act provides a classification of the systems into primary and secondary highways it was felt by this Department from the very beginning that insofar as highways in this state were concerned there would be no real difference, either in the class of work or rate of improvement in those roads designated as primary and secondary. In complying with this section of the Act therefore, it was looked upon more or less as an obligation under the Act, with no real significance in this State. That this attitude was correct, has since been proven by the work of

the Department as improvement work has gone on both classifications without regard to whether the road was classified as Primary or Secondary. The source of revenue for expenditures by the State in carrying on cooperative Federal Aid work is such that this condition will probably prevail until the entire completion of both the Primary and Secondary system. Early in 1922 an agreement was reached with the Bureau of Public Roads under which the State is permitted to build sections of the Primary System of a lesser width than that provided in the Act, thus making the Primary and Secondary systems identical so far as roadway width is concerned. This was the only real difference between the two in this State.

THE STATE HIGHWAY SYSTEM

The State Highway System designated by the legislature and from which the Seven Percent Federal Aid System was to be selected consists of the following routes:

Route 1.—From the California line near Verdi, through Reno, Lovelock, Winnemucca, Battle Mountain, Elko and Wells to a connection with the Utah State Highway System at the Utah line.

Route 2.—From a connection with Route 1 at or near Fernley, through Fallon, Austin, Eureka and Ely to a connection with the Utah State Highway System at the Utah line.

Route 2A.—From Carson City through Mound House, Dayton and Lahontan to Letteville on Route 2.

Route 3.—From Reno southward to Carson City; thence to the California line at the south end of Lake Tahoe; beginning again at Carson City thence through Minden, Wellington, Yerington, Schurz, Hawthorne, Tonopah and Goldfield to the California state line west of Lida.

Route 4.—From Tonopah by way of Nyala and Currant Creek to Ely.

Route 5.—From a connection with the California State Highway at the California line south of Las Vegas, through Searchlight to Las Vegas and from Las Vegas through Indian Springs and Beatty to a junction with Route 3 south of Goldfield.

Route 6.—From the Arizona State line near Bunkerville and Mesquite to Las Vegas and by way of Jean to the California State line.

Route 7.—From Ely to Pioche.

Route 8.—From Winnemucca by way of Paradise Hill and Quinn River Crossing to Denio and thence westward to the California State line near Cedarville.

Route 9.—From Reno northward to the California line near Purdy (Peavine).

The total mileage in this system is approximately 2,200 miles.

THE SEVEN PER CENT FEDERAL AID HIGHWAY SYSTEM

The Seven Percent Federal Aid System as designated by the State Highway Department and submitted to the Secretary of Agriculture for his approval consists of the following routes selected from the State Highway System as above outlined.

Route 1.—From the California line near Verdi, through Reno, Lovelock, Winnemucca, Battle Mountain, Elko, and Wells to a connec-

tion with the Utah State Highway System at the Utah line.

Route 2.—From a connection with Route 1 at or near Fernley, through Fallon, Austin, Eureka, and Ely to a connection with Utah State Highway System as above outlined:

Route 2A.—From Carson City to Mound House.

Route 3.—From Reno southward to Carson City; thence to the California line at the south end of Lake Tahoe, beginning again at Carson City thence through Minden, Wellington, Yerington, Schurz, Hawthorne, Tonopah and Goldfield to the California State line west of Lida.

Route 5.—From a connection with the California State Highway at the California line south of Las Vegas, through Searchlight to Las Vegas.

Route 6.—From the Arizona State line near Bunkerville and Mesquite to Las Vegas.

Route 7.—From Ely to Pioche.

Route 8.—From Winnemucca to Paradise Hill.

Route 9.—From Reno northward to the California line near Purdy (Peavine).

The total mileage in this system is approximately 1500 miles.

PROPOSED FOREST HIGHWAY SYSTEM STATE OF NEVADA

1. 4 MILES EAST OF PETERSON RANCH TO 14 MILES WEST OF EUREKA.

This is a section of the Lincoln Highway on State Highway route No. 2 from Wadsworth to the Utah State line which comprises one of the main arteries of travel through the central part of the State. The Forest section is in Lander and Eureka Counties, passes thru and adjacent to the northerly portion of the Toiyabe National Forest, and thru Austin which is the county seat of Lander County. It is on the proposed 7 per cent system. Part of this has already been constructed from Forest funds and more is being surveyed.

2. 12 MILES SOUTHWEST OF SCHELLBOURNE TO 12 MILES SOUTHEAST OF SCHELLBOURNE

This is also a section of the Lincoln Highway on route No. 2 from Ely to the Utah State Line. This section runs around the northern portion of the Nevada National Forest in White Pine County and is wholly without the forest.

3. ELY TO 5 MILES EAST OF GEYSER

This is a section of route No. 7 from Ely to Pioche, the county seat of Lincoln county and lies adjacent to and partly within the Nevada National Forest. It is within White Pine county and on the proposed 7 per cent system. This route connects at Moapa with the route from St. George, Utah, to Barstow and San Bernardino, California, which crosses the southern portion of the State of Nevada.

4. GLENBROOK TO THE STATE LINE

This is a section of route No. 3 from Reno to the California State line via Carson City and Glenbrook. The forest section runs along the easterly edge of Lake Tahoe and is designed to connect at the California State line with the Placerville-Nevada State line project

of the proposed California Forest Highway system on the route from Sacramento to the Nevada State line via Placerville. The section is adjacent to but entirely without the Eldorado National Forest, and is on the proposed 7 per cent. system. It is within Douglas County.

5. 3 MILES NORTH OF HOLBROOK TO STATE LINE

Three miles of this road are on State route No. 3 from Carson City to Holbrook, Wellington, Yerington and Goldfield. The section below Holbrook is proposed to eventually connect at Coleville, Calif., with California route No. 23 which is an extension of the 7 per cent. system route from Saugus to Bridgeport, California, accommodating a large volume of thru traffic. Three miles of the proposed project are on the proposed 7 per cent. system. It is all in Douglas County and adjacent to the Mono National Forest.

6. 12 MILES SOUTHWEST OF GOLDFIELD TO STATE LINE

This is also a section of route No. 3 from Goldfield, the county seat of Esmeralda County, to the State line via Lida, and passes through the Inyo National Forest. It is designed to connect with California project No. 63-A which is a portion of the route from Big Pine to the Nevada State line via Oasis. It is on the proposed 7 per cent. system in Esmeralda County.

7. AMOS TO McDERMITT (STATE LINE)

This section which is on route No. 8 from Winnemucca to the Oregon State line is designed to connect with the Oregon State proposed route from Enar Vale, Oregon to the Nevada State line. It is adjacent to the Santa Rosa National Forest and an extension of the proposed 7 per cent. system. It is in Humboldt County.

8. ELKO TO THE STATE LINE (NEAR OWYHEE)

This is the route from a point on the Victory Highway State route No. 1 near Elko, via Northfork to the State line. It is designed to replace the present road from Elko to the State line. It is partly within the Humboldt National Forest and all in Elko county. Local information is that Idaho proposes making a connection by building from Mountain Home on the proposed 7 per cent. system. The County has already constructed part of this road.

9. WELLINGTON TO STATE LINE (NEAR SWEETWATER)

This section of the State route from Wellington to the State line passes through the Mono National Forest and is designed to connect the 7 per cent. system of the State of Nevada with California State 7 per cent. secondary system at a point on the State line north of Bridgeport, California. No connection is at present proposed by California on its side of the line. The section is in Lyon and Mineral Counties.

10. GARDNERVILLE TO STATE LINE

This section is designed to extend from Gardnerville to the California State line and eventually connect at Woodfords with California

State route No. 23, which extends from Coleville, California, to Lake Tahoe. It is in Douglas County and adjacent to the Mono National Forest.

11. 14 MILES EAST OF TONOPAH TO 43 MILES EAST OF TONOPAH

This is a section of route No. 4 from Ely to Tonopah on the Midland Trail, the most direct route from Salt Lake City to Los Angeles and lies within and adjacent to the Toiyabe National Forest in Nye County. Part of this project has been constructed as a forest project.

12. 70 MILES EAST OF TONOPAH TO 30 MILES SOUTH OF CURRANT

This is also a section of route No. 4 from Ely to Tonopah on the Midland Trail and lies adjacent to the Nevada National Forest in Nye County.

13. CURRANT TO 7 MILES SOUTHWEST OF BARNES

This is also a section of route No. 4 from Ely to Tonopah on the Midland Trail and lies within the Nevada National Forest in Nye County. This road has been located and is at present ready for bids.

14. 10 MILES NORTH OF BARNES TO ELY

This is a section of route No. 4 from Ely to Tonopah on the Midland Trail and lies adjacent to the Nevada National Forest in White Pine County.

Tentative approval of this system has been received from the District Office of the Bureau of Public Roads. However, before it can be finally adopted and the time of construction determined, it will be necessary to go over the projects in detail with the Bureau of Public Roads and the Forest Service officials. It is therefore impossible to give further information on these projects at this time.

FINANCING THE STATE HIGHWAY SYSTEM

The subject of finances for public work is so broad that to attempt a detailed analysis of the subject would mean, possibly, the writing of a whole volume, therefore, for the purposes of this report we will confine our discussion of the subject to the field of financing state highway improvement in Nevada, and set forth only such matters as are pertinent thereto.

Certain sound, general principles have been established as to how the money should be raised, but the great question is—how much should be paid for by the present generation, and how much should be assessed to the generations to come?At the same time a similar question arises in connection with the expenditure; how much should go into a permanent, well located, properly drained substructure, and how much in the wearing surface or pavement? Then comes the question of maintenance. Who shall pay for maintenance?

It, therefore, appears to us that conditions must be analyzed as they exist, and as they will probably effect the economic welfare of the community and state.

Plate Number One.

It might be said in the beginning that the framers of the State Highway law accepted as correct the general principles of highway financing as such principles had then been established. It might also be said that the plan of operation as carried on under these principles has worked out successfully. We have come to the point now, however, where we must thoughtfully analyze this whole subject of highway finance. We are all agreed that the financing of this class of work in the past has largely been a matter of expediency. The whole nation was suddenly confronted with an insistent and growing demand for good roads to permit the use economically, and in comfort, of the growing millions of motor vehicles. The evolution of the administration of road work from the township to the county, from the county to the state, and now the co-operative administration of the state and national government may be said to be the direct result of this demand. Attention, however, during all this time, was chiefly devoted to how and where to build roads, the raising of the required funds being left to expediency, being secured from the quickest and easiest source regardless of the effect on the economic welfare of the community. Thus we have as a result of this period of expedient highway financing many cases of long term bond issues, the proceeds of which were used on work which can only be classed as maintenance, with no permanent value to this or succeeding generations. The advent of the organized Highway Department has gradually served to eliminate many of these abuses, so that today the work from a national standpoint may be said to be emerging from the expediency stage and is being placed on a sound business-like financial basis.

Viewing the situation in our own state we find that the original highway law together with other laws previously in effect provided funds for state highway construction from the following sources:

1.—Direct Taxation.
2—Motor Vehicle license fees.
3.—Fees from licensed racing.
4.—Federal aid from the government.
5—County Bond Issues redeemable through taxation.

This was supplemented at a later date with further legislation authorizing the sale of state bonds to be redeemed from the automobile license fees and at the same time such fees were increased on a parity with the fees in other states.

At this writing, therefore, we find the source of highway funds for both construction and maintenance to be as follows:

1.—Direct Taxation for highway funds.
2.—State Bond Issues redeemable from motor license fees.
3.—Fees from licensed racing.
4.—County bond issues redeemed by direct taxation.
5.—Federal aid from the national government.
6.—Outside contributions—highway associations.

Let us now analyze the financial situation. In a general way we are all agreed that original construction is a matter of capital outlay, this is also true of any extension or any replacement of an inferior by a superior type of pavement to the extent of the differences in

cost. The analogy is that of a new building added to a manufacturing plant, or the replacement of old machinery by new and improved units. Now then, what constitutes our capital funds from which we may equitably make the expenditure for new construction?

First, we find direct taxation, as obviously, practically every tax paying citizen makes use of and is benefited by improved roads This might be termed amortization charges on the plant which is manufacturing and giving road service to the public.

Second, we have bond issues, either state or county, with the redemption cost spread over a period of future years, the redemption to be by means of direct taxation. These funds are performing the same function with regrad to the amortization of the road plant as are the funds mentioned under number one.

Third, we have outside contributions made for the specific object of completing the road plant at an earlier date than would otherwise be the case. These funds are represented by Federal aid and such others as are tendered to the state as aid in highway construction only.

The foregoing may therefore be said to represent capital outlay in the construction of a state highway system whose purpose and function is service to the road user, who benefits through lessened cost in making use of the road, better community life as a result of the improvement, and the satisfying of a proven human need, the desire for individual transportation, the fulfilment of which is a social and economic necessity to our further progress.

But now, who shall pay for the upkeep or maintenance of this road plant which is delivering individual transportation service?

We know that the user of the highway is the one who obtains the first service from it, that his costs are affected as the highway is kept in condition or allowed to go to pieces and that finally much of its depreciation is due to use. It would then appear that the user should be charged with the upkeep of the road. How can the user best be charged with this maintenance? Under our present form of financing, the motor license fees which are paid by the road user are used to redeem state highway bonds, the proceeds of which bonds have been largely used in the construction of the highways. Should not this arrangement be changed to provide for the amortization of the bonds by direct tax on the community and the motor vehicle fees be diverted entirely to maintenance? Diversion of the license fees for the purpose of bond redemption was undoubtedly expediency legislation and should now be corrected.

In addition to the motor license fees a small gasoline tax should be imposed, the proceeds to be used for maintenance. The total annual charge to the average road user on the basis would probably not exceed five dollars. Concerning the gas tax the State of Maryland has this to say:

> It is our theory of road service that the construction of the roads is a benefit to the community and the community should pay; that the maintenance of roads is a liability against the user, and the user should pay. Carrying this further, we feel that if the user is to pay, he should pay in

proportion to the benefits derived, and that the tax on gasoline is the correct measure of the amount of service which the user receives from the road. Large vehicles using much gasoline, do much damage; small vehicles using little gasoline, do little damage. A small or large vehicle standing in the garage burns no fuel and does no damage, while when it is operating over the roads, it burns a definite amount of fuel, and does a definite amount of damage.

Therefore, summed up we find we have the following grouping of finances definitely divided as to capital outlay for construction, and current revenue for operation charges in the form of Maintenance.

CAPITAL OUTLAY

1.—Direct taxation.
2.—Bond Issues amortized through taxation.
3.—Outside Aid—Federal or otherwise.

MAINTENANCE EXPENSE

4.—Motor vehicle license fees.
5.—Gasoline Tax.

A GASOLINE TAX FOR HIGHWAY CONSTRUCTION AND MAINTENANCE

The gasoline tax as a means of raising highway maintenance and construction funds is becoming quite generally adopted throughout the States. There can be no question that this form of taxation is the fairest and most equitable yet proposed for raising the funds required to maintain the highways being constructed in all the States.

This Department advocated the adoption of such a tax in Nevada at the 1921 Session of the Legislature, but due to the opposition of several groups and the lack of general information bearing on the subject, the proposed measure did not emerge from Committee. We are again squarely in favor of this form of legislation and in the report of the Department just being printed for presentation to the Governor and the Legislature, definite recommendation has been made for a two cent per gallon gasoline tax, the revenue from such tax, less expense of collection, to go into the State Highway Fund and to be used for State Highway Construction and Maintenance.

REASONS FOR THE TAX

Let us make a general survey of conditions and see whether or not this form of taxation is desirable at this time. First, what do we find? That eighteen of the other States now have such a tax in effect, in every one of which it is working out successfully and without complaint on the part of the motoring public. In addition we find that practically every other State is planning a similar tax to be taken up at the next session of the State Legislature. This then places the gasoline tax almost on the plane of a national tax on the road user and he must in all States pay proportionately for the use of the road regardless of what state he may be passing through. It is thus manifest that any State which does not have such a law will be losing the benefit of revenue from the tourist who passes

through the State, receives the benefit of its improved roads, and leaves nothing in return for their use. True it will be argued by some that the tourist in passing through the State leaves many dollars, but with improved roads and consequent reduction in time required to cross the State, will not the tourist directly save, through lesser subsistence expense and lessened wear and tear on his machine, much more than the few cents he would pay in the form of a gasoline tax? The argument of keeping tourists from the State can therefore be discarded in the beginning, as obviously a man crossing the country will encounter the gasoline tax in other states and is not going to detour around Nevada to avoid a one dollar fee. On our west, California is advocating and will undoubtedly enact a gasoline tax law immediately. Wyoming is doing likewise and Oregon and Arizona already have the gasoline tax, and those others of the Western States which do not now have such a law will undoubtedly pass such an Act at once.

The question arises, why does the State need the revenue from such a tax with the large amount of Federal Aid being given to the State? The answer is the State in accepting Federal Aid obligates itself to FOREVER MAINTAIN and UP TO THE STANDARD REQUIRED BY THE FEDERAL GOVERNMENT all highways constructed or improved through Federal Aid Funds. Maintenance is the problem that is growing year by year. So far as highway construction is concerned, if the present sources of State income are left as at present and the pro rata of Federal Aid to the public land states remains as at present, construction work will be amply taken care of for some time to come. But maintenance costs are going to increase year by year in proportion to the increase in mileage of improved roads, AND WE MUST MAINTAIN THEM. What is the situation today?

Maintenance expenditures of the Department in 1922 approximated $65,000 on approximately 175 miles of completed road or approximately $375.00 per mile. Highways now completed or which will be completed early in 1923 approximate 375 miles and at a minimum estimated maintenance cost of $400.00 per mile, 1923 will require maintenance expenditures totaling $150,000.00. At the present rate of progress improved highway mileage in Nevada is being added to at the rate of about 125 miles per year, an increasing maintenance cost of about $50,000.00 per year. We cannot avoid this maintenance burden and the quicker we face the issue and lay the proper foundation for meeting the situation the better for all concerned.

WHO WILL PAY THE TAX?

Let us consider the gasoline tax from the standpoint of the motor car and truck owner. It is reasonable to assume that the average car owner will use his car for not to exceed 5000 miles per year. It is also reasonable to assume that the average gasoline consumption would approximate one gallon every 14 miles, an annual consumption of about 350 gallons. This would mean then that on the basis of a 2 cent per gallon tax the average motorist would pay an annual tax of $7.00, or about the present annual license fee on a Ford car and less than half the average fee on larger cars. Truly it cannot be said that this is an excessive burden and we feel sure that the average car

owner would not object to such a small tax if reasonably assured of the proper use of his money.

What do we find with regard to the motor truck, and particularly the truck transportation lines who are using public property for private profit? The bigger the machine the more gasoline it uses and the greater the load it carries the greater the consumption of gasoline. A contemporary authority states "It takes energy to use the highway, it takes energy to acquire and maintain SPEED, and the same thing is required to move WEIGHT." Thus we have it, energy (gasoline) for speed, and energy (gasoline) to move weight. The combination of the two represents the use of and the consequent wear and tear to which the highway is subjected.

We feel sure there is no fair-minded citizen but who will agree that the stage and truck transportation line should pay a reasonable fee for the use of a public franchise, in this case represented by the highway over which they operate. The truck owner who operates over the highways only occasionally but who carries a heavy load, and benefits accordingly through improved roads, will pay proportionately for the use of the road.

What do we find with regard to the tourist? That he makes use of our roads at the season of the year when maintenance is the most difficult and expensive; namely, during the dry summer months. Should he not, therefore, pay the small fee represented by a gas tax to partially reimburse the State for the expense incurred for his benefit? As so ably stated by our friend, the Editor of the Wyoming Highway News Letter, "We at home travel the roads at all times, be they good, bad or indifferent, but the tourist, so to speak, comes and plucks the flower without putting up with any of the labor in producing it. We do not begrudge this, in fact we welcome the tourist and want him here, but at the same time, we see no reason why he should not help pay for the good roads he enjoys while in our midst and at a rate calculated to reimburse the state on a heavy maintenance basis. The tourist also usually comes pretty heavily loaded, a large percentage of them usually equipped to camp out, and under these circumstances a two-cent tax, which means a charge of about one-seventh of a cent per mile, computed on a basis of fourteen miles per gallon of gasoline, certainly seems small enough." The amount of the gas tax, of course, would be added to the consumers' price, but with the seasonal fluctuations in gasoline price, and which price really has so small relation to production costs, it might be said that this small increase will soon be lost sight of and will not be noticeably felt by the consumers.

PROBABLE INCOME

Exact figures as to gasoline sales in Nevada in 1922 are not available but from the best information obtainable there was shipped into the State during 1922 approximately 110,000 barrels of gasoline. A two-cent tax would amount to about one dollar per barrel, thus producing a gross revenue of between $110,000 and $120,000 per year. From this, of course, would have to be deducted the expense of collections which, if the law provided for collection from the importers or distributors, would be practically nothing. It is reasonable to as-

sume of course that the annual consumption will increase year after year, thus meaning a proportionate increase in revenue.

METHOD OF COLLECTION

Undoubtedly the only proper way to handle the collection of a gasoline tax is from the wholesalers or distributors on the basis of imports into the State. In fact, all the States which have tried collection through other means have abandoned them as too expensive and susceptible to fraud, and are now collecting the tax only through the wholesalers. In this State this would mean dealing with only four companies and the expense of collection would be almost nothing. In fact, we can see no reason for considering any other method of collection.

EXEMPTIONS TO THE TAX

The Nevada Tax Review, the organ of the Nevada Public Economy League, has this to say regarding exemptions:

> "The chief objection to the gasoline tax would naturally come from those who use a considerable amount of gasoline for tractors on ranches or for hoisting engines, or for other purposes not connected with the highway. Considering the object of the tax their objection to paying it is reasonable enough; and in some states provision is made in the law to rebate the tax on gasoline not used on the highway. The objection to this is that it adds to the difficulties and cost of administering the law, and the plan is open to abuse; and anyway the ranchers and miners get the advantage of the road fund along with other people."

Colorado has had a gasoline tax law in effect for several years with tax refund provision to non-users of the highways, but we are advised that the call for refunds has so diminished that the amendment of this feature of the law is being considered. In practically all the other states no exemptions whatever are made, and in view of the relatively small percentage represented by this class of sale and in the interest of economy of administration, this matter might well be entirely disregarded in Nevada.

EXPERIENCE IN OTHER STATES

During the past few months the Department has secured copies of the gas tax law from every State having such a law in force at this time and has also requested each State to briefly outline their experience as to the desirability and effectiveness of the law. We present herewith in summarized form some of the comments of the various states:

GENERAL ATTITUDE OF THE PUBLIC

ARIZONA—"We believe that the one-cent gasoline tax levied by the State of Arizona has worked out very well and that there is no general complaint in regard to it."

ARKANSAS—"The present attitude of the public towards this tax is one of approval."

COLORADO—"The present attitude of the public is very decidedly in favor of it."

CONNECTICUT—"Naturally some adverse criticism has been made in this matter. The general public, however, has no complaint

to make, the amount of the tax for a year being comparatively small for the average car user."

KENTUCKY—"On a whole it appears that the citizens of the State have recognized the justness of the gasoline tax."

MARYLAND—"There is enthusiastic and universal approval of the gas tax by the public. In fact, the legislation was passed at the last session of the Assembly without a roll call in either House or Senate. Since its advocacy before the legislature, we have not heard a single objection to it by anyone."

MISSISSIPPI—"We believe that this bill has the approval of the people."

NORTH CAROLINA—"There seems to have been no objection whatever by the public to this tax."

PENNSYLVANIA—"Strange as it may appear, little or no protest was made against the passage of this act."

SOUTH CAROLINA—"There is general approval of a tax on sales of gasoline."

SOUTH DAKOTA—"There seems to be but very little complaint on the part of the public towards paying the tax."

WASHINGTON—"The public apparently favors this tax."

ARGUMENTS WHICH LED TO ADOPTION OF TAX

ARIZONA—"In this State the tax on gasoline has proved a very satisfactory means of raising money for road purposes. In our opinion the gasoline tax will shortly be nearly universal, and that State lines will not interfere with its operation."

ARKANSAS—"The principal argument for the adoption of the gasoline tax is the fact that this tax is the most equitable one that can be devised to force the users of our roads to bear a part of the cost."

COLORADO—'The necessity of roads and the fact that it is paid by those directly interested in bettter road facilities."

CONNECTICUT—"The adoption of the tax was due largely to the need for increased revenues. It has also been argued that this tax is more equitable for motor vehicle users inasmuch as it is directly proportionate to the use of the road and the weight of the vehicle."

KENTUCKY—"Gasoline tax was adopted in Kentucky for the reason that the large part of it was consumed in automobiles, which were believed to be the most destructive agents of our limestone highways. The idea was to place the cost of construction, reconstruction and maintenance on those who are actually wearing out the highways."

MARYLAND—"In the little State of Maryland we are collecting about $2,500,000 from motor vehicles in direct taxes, and it certainly has become a real business, and should be treated in a business way. By this we mean that every user of the road should pay for the service which he receives, no more, no less."

MISSISSIPPI—"The biggest argument used in favor of this tax in this State was that inasmuch as the automobile is the most destructive agent of the roads, the automobile owners should pay a larger part of the cost of maintenance."

OREGON—"It has the advantage of procuring some revenue from the tourist who is exempt from motor vehicle fees, and it is also an equitable tax from the fact that the tax is in proportion to the use of the roads."

SOUTH CAROLINA—"The tax on gasoline was imposed by the Legislature at its session in 1922 in response to the demand that the tax on real property be lessened and that the users of gasoline contribute to the construction and maintenance of the roads."

SOUTH DAKOTA—"The law was passed by the Legislature with very little argument on account of its being realized that the tax is equitable."

WASHINGTON—"It was urged in behalf of the tax that it placed the burden of highway construction upon those who primarily derived the chief benefit from the existence of highways."

METHODS OF COLLECTION

ARIZONA—"The tax is made at the wholesaler s, which means that the cost of collection is very small."

COLORADO—"We collect the tax from the wholesalers shipping in bulk. To attempt to collect from retailers would be an expense and not effective."

MARYLAND—"Our gasoline tax is collected from the importer or refiner, before it is offered for sale in this State. By this method we have only about twenty 'dealers' in the State, and the question of collection is greatly simplified. This method has given eminent satisfaction, and there seems to be no objections whatever to it, and really, there seems to be no other logical place at which the tax can be collected. If, as in one or two States, it is collected by the State from the filling stations, the general seller to the ultimate consumer, your 'dealers' run into the thousands with the attendant extra expense because of the smaller quantities sold, and the attendant loss from the percentage of dishonest dealers."

PROPOSITION SHOULD BE CAREFULLY STUDIED

In this article we have presented, to the best of our ability, the reasons why such a tax should be adopted at the next session of the State Legislature. Every citizen of the State should give the matter careful consideration, having in mind the fact that practically all other states are collecting this tax, and if Nevada does not collect it, the State will be losing revenue to which it is entitled from the passing tourist; that the cost of maintenance of the State Highway System will have to be otherwise met through direct taxation, and that finally the road user, who should pay for the upkeep of the roads, will scarcely feel the burden of the tax.

The Nevada Public Economy League will doubtless recommend the gasoline tax. Several other organizations are also now giving careful thought to the matter.

THE DONATIONS OF THE LINCOLN HIGHWAY ASSOCIATION.

Some revisions have been made in the various projects for which funds are being donated by the Lincoln Highway Association since our report of 1919-1920 was issued. During the last biennium also actual construction has been largely completed on several of the projects for which funds were made available by the Association. The projects covered by the agreements as they stand at present are as follows:

PROJECT NO. 1—Churchill County, covering the entire section between Grimes' Ranch and Sand Springs, across the famous Fallon Sink. Funds made available by the Association, $45,-500.00.

PROJECT NO 2—Churchill County, across Frenchman's Flat, from a point about one and one-half miles west of Frenchman's Station to a point about three and one-half miles east of the station. Funds made available by the Association, $10,000.00.

PROJECT NO. 3.—Churchill and Lander counties. From Westgate in Churchill County, to a point about eighteen miles south of Austin in Reese River Valley, in Lander County. Funds made available by the Association, $44,500.00.

PROJECT NO. 4.—Eureka County. From Hay Ranch to East Eureka County line. Funds made available by the Association, $7,500.00.

Under the agreements with the Association the funds made available were deposited in Nevada banks under escrow agreements and are subject to call by the State Highway Department as actual construction progresses on each project.

PROGRESS OF CONSTRUCTION

Progress on the various projects during the past biennium has been as follows:

PROJECT NO. 1.—The first contract on this project, covering the building of the fill across the Fallon Sinks, between Salt Wells and Sand Springs, was let and completed in 1920. In 1921 a contract was let for the placing of a six-inch crushed rock surface ten feet wide, with eighteen-foot turnouts, on the entire section between Salt Wells and Sand Springs, and this work was completed early in 1922. After going through the season of 1922, however, it was found that the crushed rock surface was not compacting into a hard, uniform surface as rapidly as expected, therefore, just recently, the Department has awarded an additional contract providing for the placing of a light topping of fine gravel over the entire project, which will serve to bind this crushed rock together and secure a uniform, compacted surface. In the Spring of 1922 a contract was also let for the grading and graveling of the section between Salt Wells and a point one mile east of Grimes' Ranch. This contract was recently completed and the Department has just granted an extension of the project to bring it into Grimes' Ranch, the work on this extension now being under way.

PROJECT NO. 2.—A contract for the construction of Project No. 2 was let in the Spring of 1922 and the job was completed and accepted in October 1922. Total cost of this project was so much less than the original estimation that only a part of the Association's funds was used. The work consisted of a graded and graveled highway, and at this writing is rapidly compacting into a solid, uniform surface.

PROJECT NO. 3.—No actual construction work has yet been done on this project. It covers the section from Westgate, in Churchill County, to near Austin, in Lander County, by way of Eastgate Ranch, Carrol Summit, Campbell Creek and Elkhorn Pass into Reese River Valley. The matter of routing on this project between Campbell Creek and Austin is still in process of negotiation with the Bureau of Public Roads, the Bureau desiring that a location leading across the Smith Creek flats, through Railroad Pass and directly across Reese River Valley into Austin be adopted. This Department has objected, taking the position that the location adopted by the State will give greater service to the population of Reese River Valley, is a better location, is located through better road building material and is no greater in distance than the route desired by the Bureau. Until this matter of routing is settled, no permanent surveys or constructions can be gotten under way on the section from Campbell Creek to Austin. The remainder of the project has been surveyed and the plans are now being prepared and it is thought that contracts can be let early in the Spring of 1923, covering the section between Eastgate and Campbell Creek. The construction of this section will open up the mountain pass through the Clan Alpine Range and will eliminate travel next season by way of Newpass Canyon. The necessary Federal, State and county funds are available and construction will be gotten under way as soon as snow conditions will permit.

PROJECT NO. 4.—Contract was awarded on November 29, 1922, covering construction of about one-half of Project No. 4, being the section from Hay Ranch to Eureka. Construction work has begun and it is probable that the job will be completed in time for the heavy tourist traffic of 1923. The remainder of the project, from Eureka to East County Line, probably can not be financed by Eureka County until 1924.

PURPOSE OF THE DONATIONS

The primary purpose of the donations of the Association was to secure the early completion of bad sections of the Lincoln Highway across Nevada. This purpose has been largely accomplished, but perhaps a greater purpose has been served in calling national attention to the necessity of outside aid to Nevada in constructing the many miles of transcontinental road within the State. A great portion of the credit for the graduated scale of Federal Aid belongs to this and similar associations who have called constant attention to the need for interstate highways.

Too much cannot be said in praise of the Lincoln Highway Association who have set up an ideal and constantly fought for it, and in addition have given material aid in its accomplishment through just such donations as have been received by this State. One or two more years will see a very nearly completed highway across the State of Nevada.

The following table shows the funds made available to the State, the amounts drawn and the balance still available on the various projects:

TABLE SHOWING PROJECTS BEING CONSTRUCTED WITH THE AID OF THE DONATIONS OF THE LINCOLN HIGHWAY ASSOCIATION

Project No.	Location.	Amount under Agreements.	Amount to be used.	Payments made	Balance available.
1	From Grimes' Ranch-Sand Springs, Churchill County..	$45,500.00	$45,295.19	$44,315.69	$979.50
2	Across Frenchman's Flat Churchill County.....	10,000.00	7,424.13	7,424.13	.....
3	From Westgate to 18 miles west of Austin, Churchill and Lander counties.....	44,500.00	44,500.00	.....	44,500.00
4	From Hay Ranch to east county line Eureka County.	7,500.00	7,500.00	.....	7,500.00
	Totals	$107,500.00	$104,719.32	$51,739.82	$52,979.50

THE DEPARTMENTAL PUBLICATION.

From the very beginning of the organization of the Department much serious thought was given to the matter of some form of Department bulletin which could be issued to keep the general public fully informed on the work of the Department. The publication of such a bulletin was finally authorized by the Board of Directors and the initial issue came out on June 11, 1921.

The publication is issued under the name of "The Nevada Highway News," is issued every two weeks, is printed in the State Printing Plant and is mailed to approximately eight hundred persons interested in Nevada's highways. When publication first began we did not know whether or not it would take well with the public, but after the very first issue written requests to be placed on the mailing list almost doubled the number of the second and following issues. Because of frequency of publication the bulletin has been kept to a maximum of eight pages of reading matter and the purpose has been to include only such matter as is of live, pertinent interest to highway improvement in Nevada. Of necessity feature articles must be brief and give a maximum of information in the fewest possible words.

As a means of announcing the award and completion of contracts, showing the progress of the work on each job and the progress of the preliminary surveys and plans on the budgeted program for each year, the publication has served a very valuable purpose to the public at large. Matter from the bulletins is also freely quoted by the press of the State and thus still wider dissemination is made of articles of interest to a particular locality.

The editorial policy has been to refrain from any controversial articles, either with the press or any group or organization; neither is any political matter permitted in any form. Efforts along the line of directing public opinion in the proper channels and to provoke careful, thoughtful analysis of the various problems which constantly arise in connection with such a vast undertaking as the building of a ten-million-dollar highway system are being constantly placed before the public in this publication.

We feel that we might well close this section of our report by again quoting the introductory statement contained in the first issue of the Nevada Highway News, which summarizes briefly the aim and purpose of the publication:

> The public ofttimes views the lack of publicity given the progress of big public enterprises as an effort to secretiveness on the part of those in authority. Such is not the fact.
>
> We of the Department of Highways are aware that the citizens of Nevada are entitled to know all that there is to know of this Department. We have never had a hesitancy to give out information, but generally the means of dissemination has been such as to reach but a few scattered people or those of one community.
>
> There are those who would give misinformation—some through ignorance and others for a purpose. This misinformation is in some degree ruinous to any organization and is not conducive to the efficient carrying on of any public enterprise.
>
> We of Nevada have inaugurated a great State highway building program to extend through the years to come—the responsibility for which is founded in a definite organization which must have the confidence of the public for whom it is working.
>
> To meet an obligation of keeping our public fully informed and to avoid the bad consequences of not doing that, we have decided to issue every two weeks a small inexpensive pamphlet similar to this one.
>
> Whether it meets with your favor or not, we should like to know it. A single stamp is a negligible expense, but it often carries with it a valuable thought.
>
> We will make many journalistic blunders, for we are not journalists, and possibly some political errors, for we are likewise not politicians.
>
> In entering upon this feature of our work, which is somewhat foreign to the profession of road-building, but a necessary part thereof, we present to you the first issue of our pamphlet with the hope that it will be viewed as a sincere effort for but the one purpose.

SURPLUS WAR MATERIAL AND GENERAL EQUIPMENT

T. J. Collins, Equipment Superintendent

DISTRIBUTION OF SURPLUS WAR MATERIALS

As stated in the Biennial Report of the Department for the years 1919-1920, all of the States have received from the Federal Government allotments of machinery and equipment which had been declared war surplus by certain Acts of Congress. The first distribution of this equipment to the various States was made under the provisions of an Amendment to the Postoffice Appropriation Bill. This Amendment provided that the Secretary of War should transfer to the Secretary of Agriculture all available war material, equipment and supplies not needed for the purposes of the War Department but suitable for use in the improvement of highways, and that the same be distributed among the Highway Departments of the several States to be used on roads constructed in whole or in part by Federal Aid. Further provision was made that the equipment be allotted among the States in the same manner as Federal Aid Funds are allotted. A later Session of Congress passed an amended bill providing further distribution of this surplus war material, known as the Kahn Bill, which Bill provided that the equipment should be distributed to the States on the basis of 20% of its value at the time distribution was made, each State to reimburse the Government to the amount of this 20% valuation, less freight and handling charges paid by the State.

The State Highway Department of Nevada received a considerable quantity of machinery and equipment under the provisions of the original Postoffice bill, and the only expense to the State in receiving such equipment was the actual freight charges, plus the expense of preparation for shipment incurred by the Army authorities. A considerable quantity of equipment was also received under the Kahn Bill, but due to the fact that most of such equipment was received from Eastern Army Camps, the amount of freight charges was so much greater than the 20% valuation placed on the equipment by the War Department that the State did not have to make direct reimbursement to the Government for any of the equipment received under this Bill.

When the Federal Highway Act was approved November 9, 1921, this Act contained a clause relating to distribution of surplus war material, practically restoring the plan originally carried in the Postoffice Bill, and it is under this clause that distribution is being continued to all the States at the present time, and the provision is as follows:

Sec. 5.—That the Secretary of War be, and he is hereby, authorized and directed to transfer to the Secretary of Agriculture, upon his request, all war material, equipment, and supplies now or hereafter declared surplus from stock now on hand and not needed for the purpose of the War Department, but suitable for use in the improvement of highways, and that the same shall be distributed among the highway departments of the several states to be used in the construction,

reconstruction, and maintenance of highways, such distribution to be upon the same basis as that hereinafter provided for in this Act in the distribution of Federal-Aid funds; Provided, That the Secretary of Agriculture in his discretion, may reserve from such distribution not to exceed 10 per centum of such material, equipment, and supplies for use in the construction, reconstruction, and maintenance of national forest roads or other roads constructed, reconstructed, or maintained under his direct supervision.

While the law does not contain specific provision as to how the distribution shall be carried out, and who shall bear the expense, it was arranged between the War Department and the Department of Agriculture that the distribution be handled entirely through the Bureau of Public Roads, that each State accept delivery of the equipment at the various army camps, that each State assume all the expense of freight charges and that the Government be reimbursed for any expense incurred in loading the equipment for shipment to the States. This arrangement is still in effect.

A great quantity of machinery and material has been received by the State Highway Department of Nevada. The original cost value of this equipment to the Government would probably approximate $3,000,000. Of course, a great quantity of this material has either been used by the Government or has been in open storage and exposed to the weather such a length of time that it has become greatly deteriorated in value. It may be said, however, that approximately ninety per cent of the material and equipment received has been of value to the Department, and has undoubtedly saved the State a large investment in equipment of similar character which would have been required to carry on its work.

From the beginning this Department adopted a policy of distributing this surplus war material among the Cities and Counties of the State, such materials or equipment to be delivered to the Cities and Counties at actual cost plus an added reasonable per cent to cover overhead expense incurred in receiving and handling the equipment. Practically every county and city in the state has taken advantage of this distribution of equipment, and elsewhere in this report there appears a statement in detail of the material transferred under this policy.

The methods of the War Department in handling the transfer of the surplus war materials to the Department of Agriculture and the allotment of the material by the Department of Agriculture to the various States did not work out very successfully during the first two years. During this time the agencies of the Department of Agriculture were confronted with the enormous task of listing and checking the great amount of material stored in many large Army Camps throughout the country, and it took practically two years to get a reasonably correct inventory of the equipment available for transfer. During this time many allotments were made to the States which were afterwards cancelled as the listing of material went on. However conditions have now improved so that at the present time

the State is practically certain of getting only such material as it requests.

At first the only information furnished to the State was an occasional telegram stating that so many tons of repair parts for a certain type of truck were available at a certain storage point, or that so many trucks were available for distribution, and inquired whether or not the State desired its prorata. Inquiry by the State failed to get definite statements as to the condition of the equipment. During the past year, however. a much better system has prevailed, and the Bureau of Public Roads now furnishes us with detailed information on all equipment and a fairly accurate statement of its condition. A larger variety of equipment is now also available for distribution to the States, the list including machine tools, small shop tools, construction material (such as expanded metal, corrugated iron, iron pipe, etc.) engineering instruments and office equipment. We have not accepted the total amount of surplus war equipment available to the State because oftentimes the condition of the equipment would not justify the expense in shipping it from far eastern points.

Approximately 5 per cent of the equipment received is not suitable to the needs of the State and a plan is now being worked out to transfer this equipment to other States that have use for it.

A separate list is attached showing in detail the equipment received under the various Acts of Congress relating to the transfer of surplus war material.

THE RENO EQUIPMENT PLANT

In order that the Department might properly care for the equipment received from the Government, they built on land owned by the State between Reno and Sparks, a very complete plant, which consists of storage sheds, machine shop, etc. In the construction of this Plant the State had to make a considerable investment but as compared with the value of the equipment received from the Government the Plant investment is nominal and is in the interest of good business management. If it could be accurately determined, it would probably be found that the saving in depreciation to the property and equipment cared for and stored there is equal to or greater than the total investment in this Plant. The Plant consists of a large machine-shop building, office and store room building, and three corrugated metal warehouses. During the past year there have also been set up at this Plant six airplane hangars which were received from the War Department. These hangars provide 62,800 square feet of additional storage space, sufficient to care for all equipment owned by the Department. The hangars are of fabricated wooden members covered with canvas and the intention of the Department is to later convert these structures into permanent buildings by reinforcing the wood frames and covering them with corrugated metal.

For the purpose of operating the Reno Plant and caring for all equipment owned by the Department there has been organized a special Department known as the Equipment Division.

OPERATION

The work of the Equipment Division is divided into three lines:

1. Construction and repair of mechanical equipment.
2. Ordering, storing and distributing surplus war equipment allotted to this State by the Department of Agriculture.
3. Purchasing, storing and shipping repair parts and supplies to the Department employees in the field and to Cities, Counties and other State Departments.

CONSTRUCTION AND REPAIR ON MECHANICAL EQUIPMENT

The machine shop is now well equipped with machine tools for handling the usual construction and repairing of motive equipment. During the past two years no purchases of machine tools have been made because changes in the plan of distribution of surplus war material made such tools available to the State at a very low cost: e.g. freight from storage point plus loading charges.

An air compressor and 10 HP electric motor received from the Government has been set up in the shop and air supplied from the machine is used to drive portable air drills, air hammers, riveters, etc.

For the period covered by this report 693 jobs were completed in the machine shop. A "Shop Work Order" is prepared for every job and a tabulated list of these "work orders" is attached showing the number of times each piece of equipment was worked on at the Reno shop. No attempt is made in this report to give in detail the work covered by shop orders. The items of equipment on which the greater number of "work orders" were issued were cars and trucks operating in the vicinity of the Reno Shops and which were turned in at Reno for all repairs, varying from small jobs of greasing the car to major jobs of complete overhauling.

The following special equipment was handled at the Reno Plant:

Two dump bodies for F. W. D. trucks were made from Ammunition Bodies.

Two 5-ton Pierce Arrow trucks were equipped with 1200-gallon water tanks and sprinkling heads and provided with 3 inch centrifugal pumps driven by the truck engine. These trucks are used for sprinkling gravel roads.

A steel crane has been built and mounted on a 5-ton Pierce Arrow Truck and the equipment is used for removing bodies and heavy loads from trucks.

One "Thew OO" gasoline crane received from the Department of Agriculture, knocked-down, was set up at the Reno Shops.

One wooden snow plow, and one steel snow plow were built. Three steel snow plows purchased from manufacturers were mounted on tractors or trucks.

Eleven of the fifteen Dodge automobiles received from the government in very poor condition have been completely rebuilt and placed in service.

Eight new White Trucks, 1 1-2-ton capacity, were received from the Government with bodies knocked-down. Four of these were

allotted to counties and four were set up at the Reno shop and used by the Highway Department.

Four White Reconnaissance cars in fair condition were received from the Government. Two of these were overhauled and put in service; one has been loaned to the Nevada State Police. Of the four White Staff cars received, two were put in running condition and one of these is now in service at Lovelock.

Six three-quarter ton G. M. C. trucks received in fair condition; four of these were provided with bodies and seats and put in running condition, two were equipped with ambulance bodies when received. One of these ambulances was transferred to the Nevada Hospital for Mental Diseases and the other used by locating parties.

Six Light Aviation one-ton trucks were received in fair condition without bodies; two were allotted to counties and the remaining four equipped with bodies, put in running condition and placed in service.

Thirty-eight ten-ton Holt Tractors and two five-ton Holt Tractors in good condition were received from the Government; thirty of these were allotted to counties and cities and the remainder set up in the Reno Shop and are now in service. Two of the ten-ton Tractors and one of the five-ton Tractors have been equipped with snow plows.

Three trailers, 1 1-2-ton capacity, have been equipped with water tanks, capacity 480 gals., and placed in service. These tanks were taken from obsolete government equipment. These tank trailers are used for storing water at dry camps, for camp purposes and for supplying water for mechanical equipment on construction jobs.

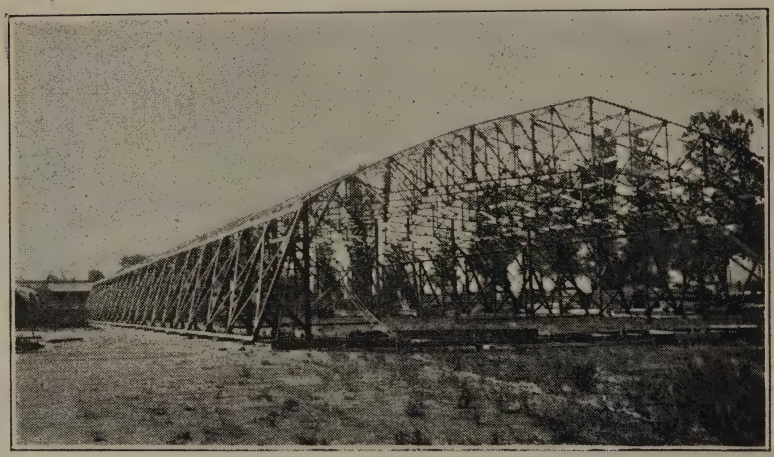
One four-ton trailer has been equipped with a cook-house constructed at the Reno Shop. This cook-house was fully outfitted with camp equipment, such as cooking range, lunch counter, stools, cupboards, etc.

PERSONNEL

The average crew employed at the Reno Storage Yards is composed of thirteen employees; 1 Superintendent, 2 Watchmen, 1 Yard Clerk, 1 Stock Clerk, 1 Stenographer and 7 Mechanics.

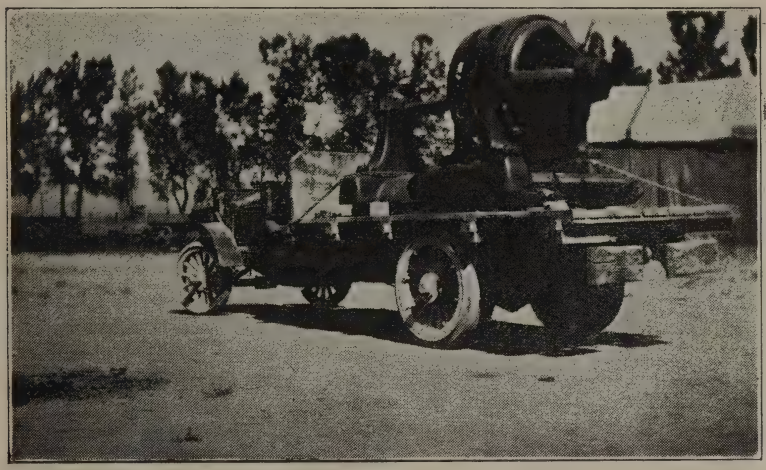
Originally three Watchmen were employed, the day Watchman acting as a foreman of the Yard laborers. When construction work in the Yard was completed the laborers and day watchman were dispensed with. A stenographer has been employed for the past six months and a stock clerk for the past year. Previously the stenographic work and store keeper work was handled by the Yard Clerk. However, the receiving, storing, and distribution of spare parts and war equipment, required the entire time of a store keeper, who also acted as shipping clerk and had charge of the tool room in the machine shop. Temporary laborers are employed for emergency work, such as erection of hangars, etc.

Mechanical employees of the Equipment Division have been tansferred during emergencies to other Divisions for handling repair work on equipment operating at points which were too far from the Reno Plant to permit having the work performed in the Plant.

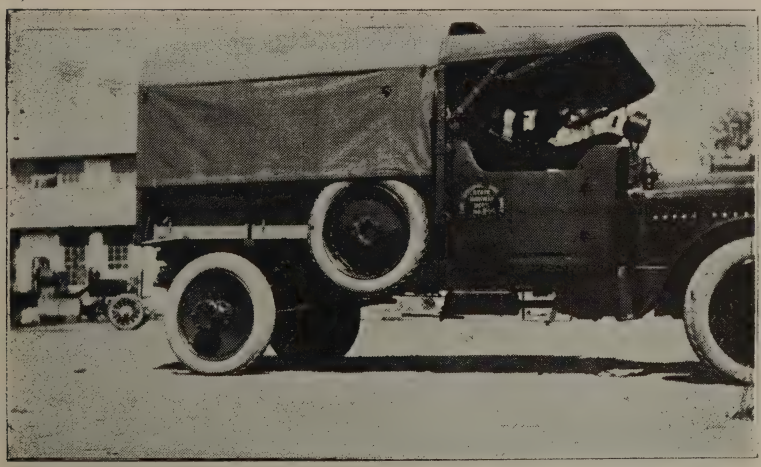


Framework of Besseneav Hangars, Ready to Receive Canvas Cover. This Hangar is 300 Feet Long and 70 Feet Wide, and Provides 63,000 Square Feet of Storage Space. Reno Equipment Plant.

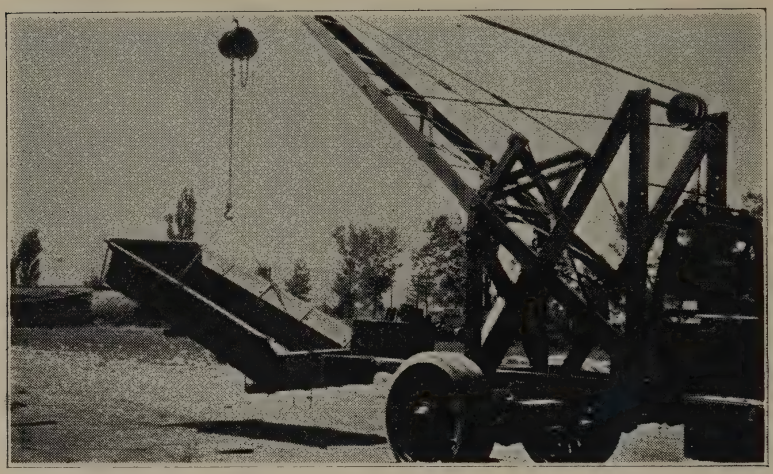
Interior View of Machine Shop. Reno Equipment Plant.



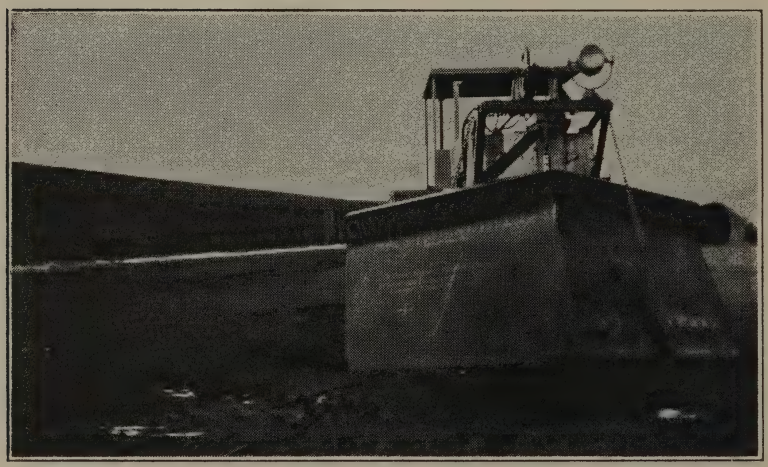
Showing 75-H.P. Electric Motor Received as Surplus War Material. This Motor Probably Cost the Government about $5,000.00. It Cost the State $300.00 for Freight. Reno Equipment Plant.



Two-ton Pneumatic Tire Truck Received as Surplus War Material. Cost to State about $350.00. Probable Cost to Government, $3,000.00. A Typical Example of the Equipment Received. Reno Equipment Plant.



Portable Crane Mounted on Five-ton Truck. Crane Designed and Built in Our Own Shops. Reno Equipment Plant.



Snow Plow Mounted on Ten-ton Holt Tractor Received from Government. Thirty-eight of these Tractors were Received and Most of Them Have Been Transferred to the Counties. Reno Equipment Plant.

Planning For The Future

Good Engineering a Basis of Progress

By HAROLD F. HOLLEY
Engineer of Surveys

SURVEYS AND PLANS

The general procedure followed by the department in the making of surveys and preparation of plans was fully described on pages 31 to 33 of the biennial report for 1919-1920. Only minor changes of detail have been made since that report was written.

Through the co-operation of the U. S. Bureau of Public Roads, we are now expediting the approval of plans. While the surveys are in progress and again upon their completion, before the plans are prepared, inspection of the project is made by a representative of the Bureau and at that time the location, drainage and position of the finished grade of the road is determined and agreed upon, so that plans prepared in accordance with this agreement can be quickly checked and approved in the Bureau office.

Prior to the passage of the Federal Aid Act of 1921, we had completed plans for many miles of highways, the designs for which were based upon the requirements of the original highway law. As the new act provided for a higher type of road, it was necessary to rework these plans in order to meet the new requirements. Therefore in January 1922, instead of having plans for our 1922 construction program ready for advertising for bids, and the office force ready to take up the preparation of plans for the season of 1923, we found it necessary to rework many of the finished designs. This duplication of work was enormous but was unavoidable. In addition to this extra work we found that as the projects were advertised the prices bid were from 30 to 40 per cent under our estimates which were based upon the high prices of 1921, and that, as a result, we were able to construct a greater mileage with the same funds than had at first been contemplated. This meant that additional surveys and plans must be rushed out, and projects that had been placed in line for 1923 construction could be advanced a year. The original scheme for the drafting room was to employ a sufficient force throughout 1922 to prepare the designs for the 1923 construction program, however this force had to be increased to take care of the enlarged 1922 program and it will be necessary to use this larger force for some months in order to catch up with the schedule of work for 1923.

On several of our projects surveyed during the last two years, it has been necessary to locate two or more alternate lines through the same country in order to select the most feasible route. In cases where several possible routes present themselves we make it a practice to survey all of them unless one or more may be eliminated by inspection. While such a policy results in a relatively high cost per mile for surveys and plans, the expense is more than justified by obtaining the most economical route. Without the information furnished by the surveys there would be no assurance that this had been done.

The tables published herewith show the status of surveys and plans from the beginning of our operations to date.

BRIDGES

Plans and estimates for the following bridges to be constructed in the future are being prepared.

Two crossings of the Truckee River, in the vicinity of Verdi and Wadsworth, approximate length 200 feet each.

Crossing of Mary's River near Deeth, approximate length 40 feet.

Crossing of the Humboldt River near Deeth, approximate length 60 feet.

Crossing of the California Wash near Moapa, approximate length 320 feet.

Crossing of the Muddy River near Moapa, approximate length 100 feet.

GRADE CROSSING ELIMINATION

Conforming to our policy that the elimination of grade crossings with railroads should be carried on as rapidly as possible, a survey of the grade crossing situation was made. It was determined that 46 grade crossings existed on the State Highway System, but that many of these occurred with branch or short lines carrying limited train service, and the need of grade crossing elimination in these cases was considered as being very remote.

In order that the proportion of the costs assessable to the railroads incident to the elimination of grade crossings might be determined, the Public Service Commission was requested to hold a hearing in accordance with Sections 18 and 18A of the Public Service Commission Law. The hearing, at which all railroad companies operating in the State were represented, took place on April 25, 1922. Representatives of this department and of the Bureau of Public Roads presented evidence in support of our contention that 50 per cent of the cost should be assessed against the railroad companies. The carriers presented no definite figures relative to their appropriate share, but as a tentative proposition suggested 12 1-2 to 25 per cent.

After considering the evidence submitted, the Public Service Commission ordered that 33 1-3 per cent. of the costs be assessed against the carriers, with the understanding that a variation of this percentage might be made in any particular case where the circumstances seemed to justify a different finding.

Plans and estimates are being prepared for the following grade separation structures, to be constructed as funds become available:

C. P. Ry. Undergrade near Fernley, Lyon County.
C. P. Ry. Overgrade near Rose Creek, Humboldt County.
C. P. Ry. Undergrade near Winnemucca, Humboldt County.
C. P. Ry. Overgrade near Shoshone Point, Eureka County.
C. P. Ry. Overgrade near Deeth, Elko County.
W. P. Ry. Overgrade near Wells, Elko County.
U. P. Ry. Undergrade near Apex, Clark County.
U. P. Ry. Undergrade near Dry Lake, Clark County.

In addition to those listed above we have eliminated several grade

crossings by re-locating the highway without asking for financial assistance from the railroads. In some cases it may be desirable to re-locate the railroad rather than construct crossings above or below grade. One such case, in the vicinity of Lawton's, Washoe County, is now before the Central Pacific Company for their consideration.

RIGHT OF WAY

It is necessary that the State have a clear title to the right of way along the route of a proposed highway before Federal Aid can be secured on the construction. The width of right of way should be at least 60 feet, and as much wider as may be deemed necessary to obtain material for the construction of the roadbed, and to assure adequate drainage. On primary highways a width of 80 feet is being acquired, and in special cases where high fills or deep cuts are necessary, we have obtained widths as great as 150 feet.

The right of way is acquired by quit claim deed where our location traverses privately owned land. No formal deeds have been executed to acquire title to rights of way across Government owned land, but it will be necessary for us to make application in a form satisfactory to the Department of the Interior before the matter is complete.

We have acquired to date rights of way aggregating 5854 acres, divided as follows: Over privately owned land 3785 acres and over Government land 2069 acres.

Plate Number Two.

Plate Number Three.

TEST OF MATERIALS

W. T. HOLCOMB, Testing Engineer

Engineers have realized for a long time that the quality of the materials entering into a piece of work is a vital factor in the strength and permanence of the work.

To determine the qualities possessed by each of the various materials used in highway construction, tests have been devised which enable the highway builder to decide whether or not a given material is satisfactory for use prior to placing it in the road. These tests may be divided into three classes, visual, mechanical and chemical. With the exception of some of the visual examinations, the majority of the tests are made in a testing laboratory especially equipped for the purpose.

The methods for making tests have been standardized by the U. S. Bureau of Standards and materials entering into the work in Nevada are tested in accordance with these standard methods and the regulations of the Bureau of Public Roads. We have equipped a laboratory in the Heroes Memorial Building and also, through the courtesy of the University of Nevada, use the testing machines located on the University campus at Reno.

Each carload of cement as it arrives for use on any project is sampled and these samples are tested in our laboratory for fineness, soundness, time of setting and tensile strength.

Sand proposed for use in concrete is sampled at the pit. These samples on arriving at our laboratory are screened through numerous laboratory sieves to determine the uniformity of grading and amount of dirt. Then after testing for presence of organic matter, briquettes are made of one part cement to three parts of the sample sand, and at the ages of seven and twenty-eight days are tested for tensile strength. This is the final test on sand before acceptance, although it may be rejected earlier because of failure to pass any one of the previous tests.

Gravel, both for concrete and for surfacing, is tested for grading, dirt content and specific gravity. Crushed rock is tested in the same manner with the additional test for hardness.

At the time of mixing concrete, either for structures or for paving, cylinders are poured six inches in diameter by twelve inches high to be tested at the age of twenty-eight days for ultimate strength in compression.

The above tests on concrete cylinders together with tension tests on reinforcing steel are all made on the Riehle Testing Machine of the University of Nevada, located in their laboratory at Reno.

As soon as a shipment of corrugated metal pipe for culvert use arrives at any project, samples of approximately four square inches area, are cut from at least one out of every ten pipes and submitted to the Laboratory for tests. More often than not, every pipe is sampled.

These pipe samples are tested for gauge, which varies for different diameter pipes, and the quantity of spelter. The latter is dissolved

by chemicals and the weight of spelter per square foot of area determined.

The asphalt which was used in the paving through the city of Sparks was tested by the Bureau of Standards in San Francisco, as our laboratory is not equipped with the necessary apparatus. Installation of additional apparatus necessary for asphalt tests is now contemplated in order to take care of asphalt tests in the future.

Following is a list of the number of tests of different materials conducted in the Department Laboratory during the two years 1921 and 1922:

Material Tested	Number of Tests Made
Cement	82
Concrete Sand	68
Concrete Gravel	43
Crushed Rock	19
Reinforcing Steel	70
Concrete Cylinders	210
Corrugated Metal Pipes	642
Surfacing Gravel	256
Clay	6
Stone Screenings	2
Total	1398

THE LAHONTAN PLANT

A description of the plant for producing sand and gravel for concrete work located at Lahontan, and owned and operated by the State Highway Department, is contained in the last biennial report. This plant has operated since July 1920 and is still in good condition.

The equipment used for bringing the material from the deposit to the plant consists of a Bagley drag bucket of 3 cubic yards capacity operated by a cable and donkey engine. The maximum radius from the plant at which this equipment can be successfully operated is about 500 feet. Within this radius nearly all of the suitable material has been removed. In fact, during the last few months the plant output ran between two and three cubic yards of sand for each cubic yard of gravel.

An immense amount of material remains untouched in the deposit beyond the 500-foot radius and the department is considering the installation of an industrial track and the use of dump cars hauled by gasoline locomotives to bring the material from the deposit, where it will be loaded with steam or gasoline shovels, to the plant. Practically all of the equipment necessary for this installation has been or can be secured from the Government supply of surplus war material.

A total of 101,916 tons of gravel and sand has been produced by the plant. A better conception can be had if we say that it would require 40 trains of 50 standard railroad cars each, all loaded to capacity, to haul this material from the plant.

This material has been used in the concrete pavements between Reno and Carson City, Minden and Gardnerville and in the city of Yerington, and stock piles have been placed at Mogul, Lawton's and Verdi for the pavement between Reno and Verdi; and at Sparks and Vista for the pavement between those places. In addition several other projects have been furnished with material for concrete structures.

Not Only Must We Build But We Must Also Maintain

So Saith Uncle Sam

The Maintenance Problem from the True Perspective

By P. L. BONEYSTEELE
Maintenance Engineer

MAINTENANCE OF THE STATE HIGHWAY SYSTEM

The problem of maintenance increases in importance in direct ratio to the increase in mileage of constructed and improved highways. In the State of Nevada prior to the organization of the State Highway Department the maintenance of roads and highways devolved entirely upon the various boards of County Commissioners. Under the plan then in effect maintenance of the roads consisted chiefly of temporary repairs to roadways and structures which could be made by such road forces as were maintained by the respective counties.

The passage of the Federal Aid Road Act however, and the acceptance of the provisions of such act by the State under the State Highway Law placed a definite and direct obligation on the state for the maintenance of such roads as were improved as State Highways under the provisions of both the Federal and State Law.

The provisions of the State Highway Act under which the State accepted the obligation for the maintenance of improved roads is contained in Section Seven which reads as follows:

> SEC. 7. "The State of Nevada hereby accepts and assents to the provisions of the act of Congress of the United States entitled 'An Act to provide that the United States shall aid the states in the construction of rural post-roads and for other purposes,' approved July 11, 1916. The State Highway Department is hereby authorized to enter into all contracts and agreements with the United States government relating to the survey, preparation of plans, construction and maintenance of roads under the provisions of the said act of Congress, to submit such scheme or program of construction and maintenance as may be required by the Secretary of Agriculture of the United States, and do all other things necessary fully to carry out the cooperation contemplated and provided for by the said Act. For the construction or improvement of rural post-roads under the said act the good faith of the state is hereby pledged to make available funds sufficient to at least equal the sums apportioned to the state by or under the United States government during each and all of the five years for which federal funds are apportioned by section 3 of said act, and to maintain at its own expense the road so constructed with the aid of funds so appropriated, and to make adequate provisions for carrying out such maintenance."

The original Federal Aid Road Act of 1916 contained a provision that each state should maintain all roads constructed under the Federal Aid funds extended to the states. Between 1916 and 1920 however, it was found that many of the states which were constructing highways under the provisions of the Federal Aid Road Act were neglecting to make proper provision for maintenance after construction. This led the next Congress to include in the amended Federal Highway Act of 1921 a very definite and drastic clause with reference to maintenance of the roads and highways constructed. This clause was included in the law to compel every state to make

adequate provisions to maintain the highways built in co-operation with the Federal Government. The maintenance clause of the Federal Act is contained in Section 14 and is as follows:

> SEC. 14. "That should any State fail to maintain any highway within its boundaries after construction or reconstruction under the provisions of this Act, the Secretary of Agriculture shall then serve notice upon the State Highway Department of that fact, and if within ninety days after receipt of such notice said highway has not been placed in proper condition of maintenance, the Secretary of Agriculture shall proceed immediately to have such highway placed in a proper condition of maintenance, and charge the cost therefore against the Federal funds allotted to such State, and shall refuse to approve any other project in such State, except as hereinafter provided.
>
> Upon reimbursement by the State of the amount expended by the Federal Government for such maintenance, said amount shall be paid into the Federal highway fund for reapportionment among all the States for the construction of roads under this Act, and the Secretary of Agriculture shall then approve further projects submitted by the State as in this Act provided."

The improvement of the State Highway System of Nevada under the provisions of the Federal Aid Road Act has been carried forward as rapidly as the work could be financed from state funds, but this department has at the same time realized the necessity of providing adequate maintenance facilities for taking care of the highways after construction. It has been the policy of the department to begin maintenance immediately upon completion and acceptance of a section of highway, and in programing the work of the department under the Budget, adequate provision is made for the maintenance of each section. Prior to the time actual construction work began on the Highway System the belief became quite general throughout the state that the Highway Department had taken over the maintenance of all roads included in the State Highway System. While it is true that the department expended funds in maintenance work on portions of the system prior to construction during the years 1918, 1919 and 1920 this work was done to better the general road conditions pending the time when the department could proceed with the letting of contracts and the beginning of actual construction work. As soon as construction began, however, the definite policy was adopted of maintaining only those sections of highway which had been constructed by the State under the provisions of the Federal Aid Road Act and been accepted as completed highways.

To December 31, 1922 the department had completed or had under construction a total of approximately 300 miles of highway which the State is obligated to forever maintain. At the present rate of progress about 150 miles of completed highway will be added each year so that the cost of maintenance which must be borne by the state will increase year after year. It should be remembered, however, that every mile of highway taken over for maintenance by th

state reduces the mileage which must be maintained by the counties, and inasmuch as the roads being constructed by the State, and which the State is obligated to maintain, are usually those roads which carry the major portion of traffic in each county, the cost of maintenance of the counties is being reduced in greater proportion than might be indicated by the actual mileage of road transfererd to the State.

MAINTENANCE POLICIES

During the past three years the department has built up a maintenance organization and has also established certain well defined policies under which maintenance operations are to be carried on in the future. These policies might be summed up as follows:

1. Maintenance only of roads which have been constructed by the department.
2. Maintenance to begin immediately upon completion of contract.
3. Adequate provisions to be made in the Budget for the necessary funds to properly maintain each section of highway.
4. Maintenance to be carried on only under the patrol system.
5. Reconstruction of highways by placing a better type of pavement where maintenance cost becomes excessive or when traffic warrants better type of road.

MAINTENANCE METHODS

During the years 1921 and 1922 maintenance of the State Highway System was carried on entirely under the patrol system. Under this system a patrolman is placed in charge of a definite section of roadway and is expected to maintain that section up to the standard required by the department. Oft-times it is necessary to assign a gang of men to the patrolman in meeting unusual situations such as a condition which might exist due to a bad washout or some other unusual contingency. Each patrolman is furnished with the necessary mechanical equipment to carry on his work and the work is co-ordinated with the other work of the department through the proper records and reports. Average costs per mile of maintenance during this period were probably greater than such costs will be during future years due to the fact that the sections of highway which have been completed and taken over for maintenance are more or less disconnected requiring a more widely scattered organization.

GRAVEL ROADS

Gravel roads when first constructed are not an entirely satisfactory surface for fast moving vehicles, but after several years of proper maintenance such roads will become a very satisfactory highway when traffic is not too heavy. Proper maintenance consists of dragging, shaping, adding new surfacing material and the removal of oversize material which has worked to the surface. In addition sprinkling with water is often required.

The maintenance of gravel roads by sprinkling with water has

proven commendable on two sections of the Highway System one section being from Yerington to a point six miles south, and the other from Fallon to Leeteville. The question of obtaining water on these two sections was comparatively easy as many irrigation ditches were located nearby. Trucks used for this work were secured from the surplus war equipment of the government, and were equipped with 1200-gallon capacity tanks and centrifugal pumps.

During the latter part of July 1922, traffic counts were taken on these two sections and it was found that the Yerington section was carrying an average of 384 vehicles per day and the Fallon section an average of 263 vehicles per day. At the time of the count both sections were in excellent condition and had been so from the time that sprinkling had begun early in the spring.

The sprinkling of gravel roads has proven to be very satisfactory and is economical where water is obtainable at intervals not greater than one mile and where the traffic chiefly consists of fast moving motor vehicles.

BITUMINOUS TREATMENT OF GRAVEL ROADS

Experiments in the maintenance of gravel roads by the use of road oils and asphalts were conducted between Minden and Cradelbaughs Bridge in Douglas County and from Fallon to Leeteville in Churchill County, in order to determine the advantages of bituminous treatment, from the standpoint of economy, both in construction and maintenance, in comparison with untreated gravel roads.

On the section from Minden to a point 3 1-2 miles north several experimental types of construction were laid and the results obtained since completion indicate most of these types will prove satisfactory, but it will be necessary to observe this section carefully for at least one year before recommending any type for further construction.

The section near Cradelbaugh's Bridge, which was a newly constructed gravel road and had not been fully compacted, was treated with one application of light road oil in the amount of one-half gallon to each square yard of surface. Soon after the application of road oil the gravel surface became compacted and developed into a very satisfactory surface.

The experiment in Churchill County, on the Fallon-Leeteville section, was not so successful as that of the other two experiments because of the fact that when the work was started the weather conditions were ideal, being warm enough to permit penetration of the road oil, but after three miles had been oiled a sudden drop in temperature occurred causing the oil to congeal thereby preventing complete penetration of the remaining five miles. It is expected, however, that in the spring when the weather becomes warm enough to permit the oil to penertate, this road will be a marked improvement over an untreated gravel surfaced roadway.

CONCRETE

The most important item of maintenance on concrete surface highways is that all the cracks and spaces between the joints be filled as

soon as noticed with melted asphalt, which serves to prevent moisture from penetrating into the subgrade between the concrete slabs and also acts as a cushion between the slabs to prevent the crumbling and breaking of the slabs' edge.

Other important operations are the building up of these earth shoulders along the edge of the concrete, cleaning ditches and culverts, and cutting weeds and brush which, if unmolested, would in time create a dangerous impediment to safe travel.

A special operation on concrete pavements inaugurated during 1922 was the painting of a four-inch black stripe down the center of the pavement. At the beginning of this work it was the intention to paint the line on curves only, but as the advantage of this line as a traffic safety guide became apparent it was decided to paint the line continuously on all concrete pavements. To do this as efficiently and as rapidly as possible a pneumatic painting machine was purchased and with this machine as much as nine thousand feet was painted by two men in a period of eight hours.

The painted line wears off rapidly under traffic and various experiments have been carried out to determine the most lasting paint. In all probability, however, it will be necessary to repaint the line at least once a year. This black stripe has been a decided factor in eliminating accidents and has received much favorable comment from the public.

SNOW REMOVAL

During the winter of 1921-1922 the problem of removing snow from the concrete highway between Reno and Carson City became one of gigantic proportions.

The first heavy snow storm occurred December 19, 1921 and from that date to February 23, 1922 it was necessary to have the forces almost continuously engaged in snow removal. At times during this period as much as nine feet of snow would accumulate in cuts on portions of the road.

For the first few weeks the roadway was kept open by towing a large "V" plow behind two four-wheel drive trucks, but as the intensity of the storm increased it was found necessary to equip caterpillar type tractors with snow plows. This method proved very satisfactory from the start.

Despite the extraordinary snow fall and the unusual drifting the roadway was kept open for travel except on three days when the equipment was laid up for repairs.

Ample preparations for snow removal during 1922-1923 and future winters have been made through the purchase and construction of the proper type of snow plows. In addition several sections of portable snow fence have been placed along the highway at points where snowdrift conditions are the worst.

THE RELATION OF TRAFFIC TO HIGHWAY MAINTENANCE

The experience of this State and of all other states is that traffic greatly increases immediately following improvement of a section

of road, in many cases the increase being remarkable. This holds true to a very large extent on the roads which have been improved by this department. This increase in traffic is partly due to greater development of adjacent territory which is a direct result of the road improvement, and to the natural increase in road users who travel purely for pleasure. Part of the increase can also be ascribed to the efforts of automobile clubs and such other organizations who are continually spreading information of road improvements and thereby inducing travel by a greater number of tourists.

During the season of 1922 the department conducted a series of traffic counts on various improved sections of the State Highway System and the increase in traffic as indicated by the traffic counts in many cases was truly remarkable. A summarized table of the traffic record is appended to this report.

The first traffic count made by the Department was on the Reno-Carson road at the junction of the Moana Springs Road, and was taken in September, 1917. No part of the road had been improved at that time and seven day's traffic totaled 3,038 vehicles of all classes. In September, 1920, after the road had been paved beyond Huffakers, the count jumped to 5,141 for seven days, an increase of 69 per cent; in September, 1921, to 7,025. and in September 1922, to 8,887, the 1922 total being an increase of 193 per cent over 1917. This then is a fair indication of what may be expected in traffic increase on the roads of the State after such roads have been improved.

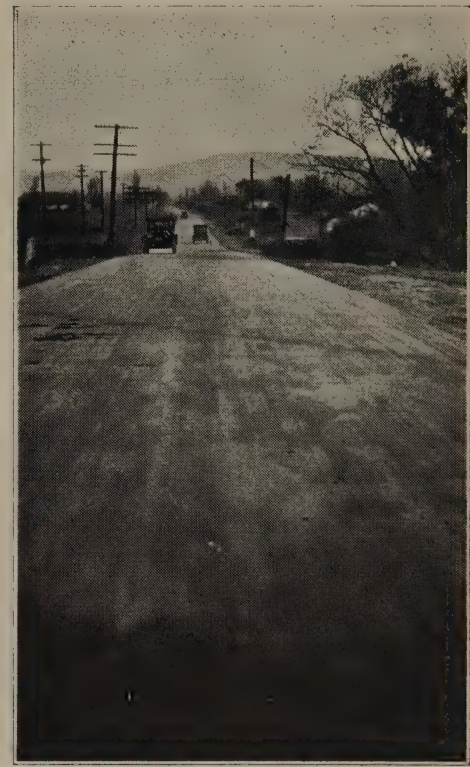
Traffic counts previous to improvement had not been taken at the various other points listed on the table; however, the daily average of vehicles passing over these roads was in many cases a surprise to the Department. Another surprising thing brought out by this traffic census is the relatively small percentage of the total represented by foreign cars—that is, cars of States other than Nevada—in two instances this class being less than the number of trucks. This will serve to explode one of the popular theories that the transcontinental tourist is the all-important and heaviest user of our highways. Unfortunately the foreign-car count was not carried out on all sections, but on all future counts such a segregation will be shown.

The table showing number and size of the trucks passing the point of census also presents some very interesting data, especially on the number of trucks classed as five-ton or over. Many of these trucks were carrying double the rated load of the truck, and it is this class of vehicle that will rapidly destroy the highways unless adequate legislation for the curbing of over-loading is passed in this State.

The Sections of the State Highway System near the towns, and which may be classed as farm-to-market roads, as indicated by the traffic record, are the sections of importance, and should receive first consideration whenever possible.

Machine Painting of the Black Traffic Line on Concrete Pavements

Showing Type of Warning Sign and Lamp Signal Installed on All Curves by the State Highway Department



Completed Asphaltic Concrete Highway. City of Sparks, Washoe County

Tabular Information Relating To All Phases *of* State Highway Construction Work

TABLE SHOWING SURPLUS WAR MATERIAL AND EQUIPMENT ACCOUNTS

RENO PLANT—CONSTRUCTION AND OPERATION ACCOUNTS

Items.	1920.	1921.	1922.	Plus trans. accts. from War Material.	Totals.
Plant construction and equipment	$31,876.77	$5,003.93	$2,311.49	$5,968.08	$45,160.27
Stock accounts	10,063.58	18,419.23	21,795.46	5,376.19	55,654.46
Plant overhead and general yard	14,326.99	14,630.96	13,702.69	243.00	42,903.64
Equipment unit funds	22,258.50	13,558.97	7,186.04	24,487.70	67,491.21
Totals	$ 78,525.84	$51,613.09	$44,995.68	$36,074.97	$211,209.58
Inventory value of plant					38,386.27
Net operation expense					$172,823.31

RENO PLANT—INCOME ACCOUNTS

	1920.	1921.	1922.		
Equipment rentals	$34,373.26	$22,694.58	$12,460.18	.....	$69,528.02
Equipment purchased and sold	12,674.41	.....	.....	.....	12,674.41
Stock sales	19,623.92	23,985.45	28,441.46	.....	72,050.83
Labor profits	2,600.21	3,666.27	2,907.46	.....	9,173.94
Totals	$69,271.80	$50,346.30	$43,809.10	.....	$163,427.20
Inventory value stock transferred W. M. account				$5,376.19	
Inventory value stock purchased				3,519.28	8,895.47
Total plant income					$172,322.67

SURPLUS WAR MATERIAL ACCOUNT

	1919.	1920.	1921.	1922.	Totals.
Total expenditure	$59,211.78	$41,449.66	$35,379.00	$36,466,87	$172,507.31
Total sales	7,999.38	15,207.88	25,733.74	23,960.88	72,901.88
Inventory value	$51,212.40	$26,241.78	$9,645.26	$12,505.99	$99,605.43
By transfer to Reno plant accounts					36,074.97
Net investment surplus war material, 11-30-22					$63,530.46

PROGRESS OF CONSTRUCTION
ROAD PROJECTS

Type of Construction	Miles Completed 1917 1920	Miles Completed 1921 1922	Miles Under Contract	Totals
Grading only	89.03	16.29	36.81	*142.13
Grading and gravel, shale, crushed rock surface	64.26	53.73	94.15	212.14
Grading and Portland cement concrete surface	13.79	21.43		35.22
Grading and asphalt concrete surface		1.59		1.59
Gravel surface, projects previously graded		35.88	19.63	
Asphalt macadam, projects previously graded		3.45	15.57	
Totals	167.08	132.37	166.16	
Grand total miles complete or under contract				391.08

*74.53 miles of these 142.13 have been or are being surfaced.

BRIDGE PROJECTS

Type of Construction	Completed 1917 1920	Completed 1921 1922
Concrete pile trestles	2—306 ft.	2— 274
Concrete girder bridges	1— 90 ft.	1— 50
Concrete arches	2—115 ft.	
Steel truss bridge	1—126 ft.	1— 252
Timber trestle		1— 708
Timber truss bridge		1— 110
	6—637 ft.	6—1394

Total length bridges completed, 2031 lin. ft.—0.40 mile.

Table Number One.

STATEMENT OF RECEIPTS

CLASS OF INCOME	1917-1922	Total Revenue	Total Refunds
Legislative appropriation	$40,000.00	$40,000.00	
Taxes—Net amount received	826,564.48	826,564.48	
Automobile License fees	94,919.10	94,919.10	
Racing commission fees	77,397.67	77,397.67	
Miscellaneous refunds	1,026.05		$1,026.05
Sales and service—Accounts receivable	280,777.73	280,777.73	
Right of way refunds	6,076.78		6,076.78
State highway bonds	800,000.00	800,000.00	
Federal construction refunds	1,832,883.48		1,832,883.48
County construction refunds	1,108,703.15		1,108,703.15
Lincoln Highway Association	38,532.99		38,532.99
City construction refunds	25,205.79		25,205.79
Special maintenance deposits	2,000.00		2,000.00
Grand total of income	$5,134,087.22		
Total revenue		$2,119,658.98	
Total refunds			$3,014,428.24

Table Number Two.

COMPARISON OF ACTUAL WITH BUDGETED EXPENDITURES
1922

	1922 Budget	1922 Actual	Increase over Budget	Budget Saving
ADMINISTRATIVE				
Executive department	$ 9,400.00	$ 11,828.59	$ 2,428.59	
Auditor's dept.	18,920.00	16,454.22		2,465.78
Executive eng. dept	9,340.00	9,906.92	566.92	
Office expense	3,150.00	7,927.99	4,777.99	
Field operations	9,000.00	6,247.76		2,752.24
Special	7,600.00	6,637.75		962.25
Building expense	5,000.00	3,469.34		1,530.66
Miscellaneous	4,950.00	6,749.04	1,799.04	
Sub-totals	67,360.00	69,221.61		
DIVISION OFFICES				
Division 1—Las Vegas	3,600.00	2,047.87		1,552.13
Division 2—Reno	3,500.00	3,398.72		101.28
Division 3—Elko	6,300.00	5,799.46		500.54
EQUIPMENT DIVISION				
Surplus war material	10,000.00	12,505.99	2,505.99	
Reno plant	27,000.00	1,478.54		25,521.46
FIELD OPERATIONS				
Surveys	40,857.00	67,622.48	26,765.48	
Plans and estimates	24,116.00	22,466.59		1,649.41
Rights of way		8,869.96	8,869.96	
Maintenance	55,064.31	61,997.55	6,933.24	
Non-participating totals	$237,797.31	$255,408.77	$ 54,647.21	$ 37,035.75

Net increase actual over budgeted non-participating expense equals.....$17,611.46

Table Number Ten.

STATEMENT OF DISBURSEMENTS

CLASSIFICATION ASSET ACCOUNTS	1917 to 1920	1921 to 1922	Grand Total	Percentage
Highway construction	$1,551,278.59	$2,306,713.50	$3,857,992.09	72.70
Surveys, plans and prelim eng.	144,404.33	141,977.06	286,381.39	5.40
Plant inventories	100,323.55		100,323.55	1.89
Equipment inventory accounts	180,702.82	75,532.40	256,235.22	4.83
Reno plant		96,608.77	96,608.77	1.82
Lahontan plant		19,798.29	19,798.29	.37
Accounts receivable	64,320.27	126,947.12	191,267.39	3.60
Section 31 refunds and special transfers	31,629.46	8,477.71	40,107.17	.76
Hafed plant		472.33	472.33	.01
EXPENSE ACCOUNTS				
General administration	133,456.20	138,317.09	271,773.29	5.12
Maintenance	90,047.91	95,598.81	185,646.72	3.50
Grand total	$2,296,163.13	$3.010,443.08	$5,306,606.21	100.00

Table Number Five.

CLASSIFIED CONSTRUCTION EXPENDITURES, 1921-1922

Proj. No.	Cont. No.	Location	Contract Payments	10 Pct. Fund Payments	Materials by State	Total Costs During Biennium
1	1	Humboldt River Bridge		$ 38.31	$ 707.44	$ 745.75
3	2	Concrete Bridge over Truckee—Carson		14.65		14.65
3	3	Concrete Pile over Carson		32.41	716.67	749.08
8	5	Concrete Bridge—Walker River	4,808.18			4,808.18
6	7	Gravel Road—Keystone to Robinson Summit	21,073.98	2,568.32	1,208.88	24,851.18
5	8	Gravel Road—Elko to Vivian	87,834.16	10,248.28	63.47	98,145.91
11	9	Graded Road—Tonopah to Goldfield	4,526.49	2,558.83		7,085.32
9	12	Concrete Road—Reno to Huffakers	18,483.79	745.45	4,001.22	23,230.46
21	13	Concrete Road Reno-Sparks			196.31	196.31
7	14	Grading—Huffakers to Washoe Summit	2,842.94	53.78	23.07	2,919.79
14	15	Gravel Road 3 miles north of Minden to Minden	2,838.29	136.38	8,450.10	11,424.77
3	16	Gravel Road—Fallon to Leeteville	11,180.28	670.28		11,850.56
24	17	Gravel Road—Salt Wells to Sand Springs	11,804.91	91.90		11,896.81
17	18	Gravel Road Yerington to 6.25 miles south		22.85	79.91	102.76
1	20	Gravel Road Lovelock-Zola	6,063.37	1,828.87	1,498.26	9,390.50
7	21	Concrete Road—Browns to Huffakers	305.99	26.00		331.99
23	22	Graded Road—Walker Lake	125,534.16	11,811.06	109.28	137,454.50
27	24	Steel Virgin River Bridge	50.07	4.04		54.11
19	26	Gravel Road Zola-Mill City	46,751.06	9,541.55	470.12	56,762.73
30	27	Grading Lakeview-Carson	99.95	65.52		165.47
7	28	Concrete Road—Huffakers to Washoe	121,332.78	15,180.69	110,862.33	247,375.80
29	29	Concrete Road—Washoe to Bowers	70,345.13	11,276.47	58,024.40	139,646.00
27	30	Virgin River Bridge	61,594.33	3,507.49	2,036.70	67,138.52
9	31	Evans Creek Bridge	1,886.26	68.26		1,954.52
7	32	Concrete Road—Browns to Steamboat	1,454.51	41.13		1,495.64
22	33	Steel—Humboldt River Bridge to Dunphy		3.97		3.97
12	34	Gravel Road—Hudson-Aurora Road—Smith Corners	7,428.89	1,460.51	1,614.93	10,504.33
22	35	Humboldt River Bridge—Dunphy	8,674.28	1,167.70		9,841.98
28	36	Concrete Road—Minden to Gardnerville	6,302.33	1,031.85	20,394.67	27,728.85
29B	37	Grading—Bowers to Lakeview	22,927.60	3,474.06	2,256.94	28,658.60
29B	38	Grading—Bowers to Lakeview	20,922.95	3,873.00	2,485.10	27,281.05
14	39	Gravel Road 3 miles north of Minden to Minden	7,856.81	2,824.78	1,367.96	12,049.55
35	40	Muddy River Bridge	9,197.44	1,145.11	196.55	10,539.10
34	41	Two Concrete Bridges—Carson River	27,174.36	2,699.52	18.90	29,892.78
29B	42	Concrete Road—Bowers to Lakeview	61,774.13	7,210.99	112,370.66	181,355.78
24	43	Gravel Road—Grimes Ranch to Sand Springs	62,858.20	5,551.49		68,409.69
36	44	Grading—Reno to Purdy	58,669.80	7,488.40	12.00	66,170.20
42	45	Gravel Road—Apex Summit to Las Vegas	24,171.87	3,772.53		27,944.40
33	46	Graded Road—Yerington to Wilson	39,504.85	6,880.91	2,567.02	48,952.78
8A-12	47	Gravel Road—Hudson Aurora to Wilson	40,607.73	2,765.02		43,372.75
34	48	Gravel Road—Hazen to Leeteville	48,906.14	6,943.50	27,795.23	83,644.87

19B	49	Gravel Road—Zola to Mill City	55,876.04	4,040.98		59,917.02
38A	50	Gravel Road—Minden to North County Line	23,462.19	2,934.14	4.25	26,400.58
30-60	51	Concrete Road—Lakeview to Carson	48,089.79	3,626.84	67,688.64	119,405.27
32-47	52	Gravel Road—Valmy to East County Line	44,941.72	5,456.06		50,397.78
18	53	Gravel Road—Elko to Halleck	55,092.22	7,987.74		63,079.96
10	54	Gravel Road—Robinson Summit to Illipah	27,358.66	6,440.83	621.96	34,421.45
44	55	Gravel Road—Pancake Summit to Illipah	57,641.87	8,015.99		65,657.86
45	56	Gravel Road—Frenchmans Flat	19,151.14	3,550.47	2.40	22,704.01
16	57	Gravel Road—West County Line to Battle Mountain	8,928.92	1,935.83		10,864.75
24	58	Gravel Road—Grimes Ranch to Sand Springs	7,493.74	1,663.84	2.40	9,159.98
26	59	Graded Road—Reno to Lawtons	15,043.96	2,461.36	3,014.13	20,519.45
36	60	Grading—Reno to Purdy	17,370.60	577.95		17,948.55
48	61	Asphaltic Concrete Road—City of Sparks	28,253.29	1,255.11		29,508.40
59	62	Concrete Road—City of Yerington	21,699.36	1,437.95	34,278.47	57,415.78
22	63	Gravel Road—West County Line to White House	11,623.41	1,750.47		13,373.88
36	64	Asphalt Macadam Road—Reno to Purdy	4,973.00	417.75	29.099.94	34,490.69
	65	Crushed Rock		8.87	4,249.76	4,258.63
58	66	Gravel Road—South County Line to Winnemucca		479.80		479.80
66	67	Gravel Road—Hazen to Wadsworth		31.61		31.61
24	68	Gravel Road—Grimes Ranch to Sand Springs		2.50		2.50
68	69	Gravel Road—Pioche to Stone House		16.67		16.67
31	70	Gravel Road—Eureka to Hay Ranch		12.33		12.33
30 DL	1	Grading—Lakeview to Carson	3,833.93	56.66		3,890.59
25B-DL	3	Graded Road—Keystone to Ely	31,575.66	2,471.57		34,047.23
DL	4	Oil Surface Road—Minden to North County Line	18,227.58	182.79		18,410.37
Sec.	8	Forest Road Work—Lander and Nye Counties	3,049.14	14.05		3,063.19
St. Pile		Reno to Lawtons—Rock and Sand			36,381.18	36,381.18
St. Pile		Sparks to Vista—Rock and Sand			22,925.91	22,925.91
St. Pile		City of Fallon—Rock and Sand			3,572.95	3,572.95

GRAND TOTALS

Contract Payments	$1,551,474.23			
10 Pct. Fund Payments		$ 185,656.02		
Materials by State			$ 561,370.11	
Total Costs During Biennium				$2,298,500.36

Table Number Six.

TABULATION OF FEDERAL AID PROJECTS

Proj. No.	County	From	To	Type	Length	Miles	Status
1	Pershing	Lovelock	Zola	Gravel		16.70	Complete
		Concrete Pile Trestle over the Humboldt River			144 Ft.		Complete
2	Nye	Tonopah	Toiyabe Forest	Gravel		14.75	Complete
3	Churchill	Fallon	Leeteville	Gravel		7.57	Complete
		Concrete Pile Trestle over the Carson River			162 Ft.		Complete
		Concrete Girder Bridge over the Truckee-Carson Canal			90 Ft.		Complete
4	Douglas	Carters	Holbrook	Crushed Rock		4.00	Under Agreement
5	Elko	Elko	Vivian	Gravel		18.73	Complete
6	White Pine	Keystone	Robinson Summit	Gravel		12.46	Complete
7	Washoe	Huffakers	Washoe Summit	Concrete		9.32	Complete
8 A	Lyon	Bulkhead	Hudson Aurora Rd.	Gravel		4.19	Complete
8 B	Lyon	Concrete Arch Bridge over the West Walker River			80 Ft.		Complete
8 C	Lyon	Wilsons	Bulkhead	Grading		2.73	Complete
9	Washoe	Reno	Huffakers	Concrete		5.42	Complete
		Concrete Arch Bridge over Evans Creek			35 Ft.		Complete
10	White Pine	Robinsons Summit	Illipah	Gravel		15.01	Under Construction
11	Esmeralda	Tonopah	Goldfield Road	Grading		8.93	Complete
12	Lyon	Hudson Aurora Road	Smiths Corners	Gravel		2.31	Complete
13	Nye	Butlers Ranch	Troy Road	Grading			Project to be Cancelled
14	Douglas	3 Miles North of Minden	Minden	Gravel		3.45	Complete
15	Elko	West Elko County Line	Vivian	Grading		8.34	Under Agreement
16	Lander	West Lander County Line	Battle Mountain	Gravel		8.52	Complete
17	Lyon	Yerington	5.89 Miles South	Gravel		5.89	Complete
18	Elko	Elko	Halleck	Gravel		19.83	Under Construction
19	Pershing	Zola	Mill City	Gravel		27.81	Complete
20	Douglas	Carters	2 Miles North				Project to be Cancelled
21	Washoe	Reno	Sparks	Concrete		0.97	Complete
22	Eureka	West Eureka County Line	White House R'ch	Gravel		4.38	Under Construction
22 A	Eureka	Steel Truss Bridge over the Humboldt River			126 Ft.		Complete
23	Mineral	Dutch Creek	11 Miles North	Grading		11.00	Complete
24	Churchill	Grimes Ranch	Sand Springs	Crushed R. & Gr.		16.80	Under Construction
25	White Pine	Keystone	Ely	Grading		4.60	Partially Completed
26	Washoe	Reno	Lawtons	Selected Material		3.70	Under Construction
27	Clark	Steel Truss and Timber Trestle Bridge over Virgin River			960 Ft.		Complete
28	Douglas	Gardnerville	Minden	Concrete		1.80	Complete
29	Washoe	Washoe Summit	Lakeview	Concrete		10.47	Complete
30	Ormsby	Carson City	Lakeview	Concrete		3.48	Complete
31	Eureka	Hay Ranch	Eureka	Gravel		11.15	Under Construction
32	Humboldt	1.6 Miles West of Valmy	East County Line	Gravel		7.51	Complete
33	Lyon	6.25 Miles South of Yerington	Wilson	Gravel		7.04	Complete
34	Churchill	Hazen	Leeteville	Gravel		8.29	Complete
35	Clark	Concrete Girder Bridge			50 Ft.		Complete
35	Clark	Timber Truss Bridge over the Muddy River			110 Ft.		Complete
36	Washoe	Reno	Purdy	Asphalt Macadam		15.57	Under Construction

37	Clark	Dry Lake Station	Dugway Summit	Gravel			Under Agreement, see Proj. 50
38 A	Douglas	Minden	North County Line	Gravel		2.37	Complete
38 B	Douglas	2 Concrete Pile Trestles over the Carson River and Sloughs			74 & 200 Ft.		Complete
39	Clark	Las Vegas	Tule				To be Cancelled
40	Clark	Tule	Owens				To be Cancelled
41	Clark	Owens	Indian Springs				To be Cancelled
42	Clark	Apex Summit	8 Miles Southwest	Gravel		8.00	Under Construction
43	Clark	Dry Lake	Valley of Fire	Grading			Under Agreement, see Proj. 51
44	White Pine	Pancake Summit	Illipah	Gravel		22.95	Under Construction
45	Churchill	1.5 Miles West of Frenchmans	3.5 Miles East	Gravel		5.00	Complete
46	Nye	6.9 Miles Southwest of Canon	3.6 M. SE. Rosewell	Gravel		14.85	Portion Under Construction
47	Humboldt	1.67 Miles West of Valmy	5 Miles West	Gravel		3.33	Complete
48	Washoe	City of Sparks		Asphaltic Concrete		1.59	Complete
49	Churchill	City of Fallon		Concrete		1.22	Project Approved
50	Clark	Apex Summit	Crystal	Gravel		17.00	To supercede P. 37; portion adv
51	Clark	Crystal	W. Sl. M'mon Mesa	Gravel		20.00	To supercede Proj. 43
52	Clark	West Slope	E. Sl. M'mon Mesa	Gravel		18.00	Project Submitted
53	Clark	East Slope Mormon Mesa	State Line	Gravel		12.00	Project Submitted
54	Elko	Deeth	Wells	Gravel		22.00	Project Submitted
55	Churchill	West Gate	East Gate	Gravel or Cr. Rk.		10.00	Project Approved
56	Churchill and Lander	East Gate	Campbell Cr. Rch.	Gravel or Cr. Rk.		17.30	Project Approved
57	Lander	Campbell Creek Ranch	Peterson Ranch	Gravel		6.70	Project Submitted
58	Humboldt	South County Line	Winnemucca	Gravel		13.20	Under Construction
59	Lyon	City of Yerington		Concrete		1.43	Complete
60	Ormsby	City of Carson		Concrete		0.49	Complete
61	Lander	Reese River	Big Creek	Gravel		14.50	Project Statement Submitted
62	Lander	Big Creek	Austin	Grading		9.70	Project Statement Submitted
63	Lander	Peterson Ranch	Reese River	Gravel		10.50	Project Statement Submitted
64	Churchill	Fallon	Grimes	Gravel		10.50	Portion Advertised for Bids
65	Washoe	Sparks	Vista	Concrete		3.00	Project Approved
66	Washoe, Lyon and Churchill	Hazen	Wadsworth	Gravel		15.65	Portion Under Construction
67	Douglas	Cave Rock	Lakeside	Crushed Rk. or Gr.		7.20	Project Approved
68	Lincoln	Pioche	Stone House	Gravel		13.51	Under Contract
69	Lincoln	Pony Springs	Dutch John	Gravel		9.56	Advertised for Bids
70	White Pine	City of Ely		Asphalt Macadam		2.10	Project Approved
71	Humboldt	Toll House	Paradise Hill	Gravel		13.00	Project Approved
72	Humboldt	Winnemucca	Toll House	Gravel		13.00	Project Approved
73	Washoe	Lawtons	2 Mi. E. of Verdi	Concrete		4.50	Project Submitted
				Total.....	.....	626.87	

Table Number Sixteen.

STATE HIGHWAY DEPARTMENT OF NEVADA

TABLE SHOWING CONDITION COUNTY-STATE HIGHWAY FUNDS—NOV. 30, 1922

County	Estimated receipts to Nov. 30, 1922.	Payment or obligated, 1922.	Available balance, Nov. 30, 1922.	Estimated receipts, 1st payment of 1922 tax.
Churchill	$14,898.61	$14,898.61		$5,400.00
Clark	16,801.32	16,801.32		5,100.00
Douglas	4,605.76	4,605.76		2,100.00
Elko	141,290.04	30,585.82	$110,704.22	21,500.00
Esmeralda	4,075.63	4,075.63		2,100.00
Eureka	31,535.71	31,535.71		4,100.00
Humboldt	81,155.41	32,411.44	48,743.97	9,500.00
Lander	11,295.00	9,677.13	1,617.87	3,750.00
Lincoln	8,129.77	8,129.77		4,700.00
Lyon	13,017.56	13,017.56		6,200.00
Mineral	6,276.59	6,276.59		2,700.00
Nye	33,174.65		33,174.65	5,950.00
Ormsby	1,875.96	1,875.96		1,050.00
Pershing	13,701.56	13,701.56		7,900.00
Storey—No State Highway				
Washoe	36,519.44	36,519.44		20,250.00
White Pine	57,628.25	57,628.25		9,000.00
TOTALS	$475,981.26	$306,136.43	$194,240.71	$111,300.00

TABLE SHOWING CONDITION COUNTY HIGHWAY BOND FUNDS—NOV. 30, 1922

County	Total authorized.	Sold to date.	Used to date.	Cash available.	Unsold bonds available.
Churchill	$ 100,000.00	$ 21,000.00	$ 19,858.85	$ 1,141.15	$ 79,000.00
Clark	150,000.00	115,000.00	22,246.14	92,753.86	35,000.00
Douglas	125,000.00	125,000.00	124,207.73	792.27	
Humboldt	75,000.00				75,000.00*
Lander	30,000.00	10,000..00		10,000.00	20,000.00
Lincoln	50,000.00				50,000.00
Lyon	50,000.00	50,000.00	38,990.84	11,009.16	
Mineral	30,000.00	30,000.00	30,000.00		
Pershing	75,000.00				75,000.00*
Washoe	650,000.00	500,000.00	456,653.94	43,346.06	150,000.00*
White Pine	150,000.00	150,000.00	15,016.74	134,983.26	
TOTALS	$1,485,000.00	$1,001,000.00	$706,974.24	$294,025.76	$484,000.00

*Denotes contingent issues.

Table Number Seven.

TABLE SHOWING FEDERAL AID ALLOTMENTS TO NEVADA

Fiscal Year	From	Act of 1916	Amendment of 1919	Act of 1921	Act of 1922	STATUS OF ALLOTMENTS: Grand Totals	Covered by Project Agreement	Not covered by Project Agreement	Payments to State
1917	7-1-16—6-30-17	64,398.30				$ 64,398.30	$ 64,398.30		$ 64,398.30
1918	7-1-17—6-30-18	128,796.60				128,796.60	128,796.60		128,796.60
1919	7-1-18—6-30-19	193,229.82	$ 642,933.46			836,163.28	836,163.28		836,163.28
1920	7-1-19—6-30-20	257,173.38	964,400.19			1,221,573.57	1,221,573.57		803,525.30
1921	7-1-20—6-30-21	319,086.11	957,258.32			1,276,344.43	1,183,908.99	92,435.44	
1922	7-1-21—6-30-22			$953,436.78		953,436.78		953,436.78	
1923	7-1-22—6-30-23				$ 635,624.00	635,624.00		635,624.00	
1924	7-1-23—6-30-24				826,410.00	826,410.00		826,410.00	
1925	7-1-24—6-30-25				953,437.00	953,437.00		953,437.00	
GRAND TOTALS		$962,684.21	$2,564,591.97	$953,436.78	$2,415,471.00	$6,896,183.96	$3,434,840.74	$3,461,343.22	$1,832,883.48

Table Number Fifteen.

TABLE SHOWING COST PER MILE OF PLANS AND ESTIMATES 1917 TO 1922 INCLUSIVE

County.	Project No.	Route.	Section.	FROM	TO	Miles plans completed, 1917-1920.	Miles plans completed, 1921-1922.	Total miles plans completed.	Cost of plans and estimates 1917-1920.	Cost of plans and estimates 1921-1922.	Total cost of plans and estimates.	Cost per mile of plans and estimates.
..	26											
Washoe	73	1	A	State Line	Reno	.....	6.60	6.60	$5.62	$1,866.53	$1,872.15	$283.66
Washoe	21	1	B1	Reno	Sparks	0.97	.....	0.97	148.17	.....	148.17	152.75
Washoe	65	1	B2	Sparks	Vista				.....	56.66	56.66	.....
Washoe	48	1	B3	City of Sparks		.....	1.59	1.59	.....	472.20	472.20	296.98
Washoe	66	1	D	Clark	E. Co. Line	.....	0.91	0.91	.....	504.06	504.06	553.91
Pershing		1	B	Toulon	Lovelock				7.26	.....	7.26	.....
Pershing		1		City of Lovelock					.....	31.58	31.58	.....
Pershing	1	1	C	Lovelock	Zola	16.70	.....	16.70	861.64	.....	861.64	51.60
Pershing	19	1	D	Zola	Mill City	27.81	.....	27.81	1,463.71	69.22	1,532.93	55.12
Humboldt	58	1	A	S. County Line	Winnemucca	.....	12.99	12.99	.....	2,259.23	2,259.23	173.92
Humboldt		1	C	Golconda	Stone House				21.08	.....	21.08	.....
..	47											
Humboldt	32	1	D	Stone House	E. County Line	3.00	7.84	10.84	20.35	588.36	608.71	56.15
Lander	16	1	A	W. County Line	E. County Line	8.52	.....	8.52	402.90	510.97	913.87	*107.26
Eureka	22	1	A	W. County Line	E. County Line	6.31	.....	6.31	678.24	31.30	709.54	112.45
Elko	15	1	A2	W. County Line	Vivian	8.34	.....	8.34	362.58	.....	362.58	43.47
Elko	5	1	A1	Vivian	Elko	18.73	.....	18.73	814.28	.....	814.28	43.47
Elko		1	B	City of Elko		.....	0.79	0.79	.....	306.42	306.42	387.87
Elko	18	1	B	Elko	Halleck	19.83	.....	a19.70	544.32	714.71	1,259.03	63.91
Elko	54	1	D	Deeth	Wells	.....	8.06	8.06	.....	682.67	682.67	84.70
Lyon	66	2	A	W. County Line	E. County Line	.....	12.83	12.83	.....	1,625.43	1,625.43	126.69
..	66											
Churchill	34	2	A	W. County Line	Leeteville	8.29	1.73	10.02	470.97	512.16	983.13	98.12
Churchill	3	2	B	Leeteville	Fallon	7.62	.....	7.62	696.00	.....	696.00	91.34
Churchill	49	2	B	City of Fallon		.....	1.22	1.22	.....	656.24	656.24	537.90
Churchill	64	2	C3	Fallon	Grimes Ranch	.....	5.94	5.94	.....	1,083.88	1,083.88	182.47
Churchill	24	2	C1, 2	Grimes Ranch	Sand Springs	10.42	5.40	15.82	289.96	458.99	748.95	47.34
Churchill	45	2	D	Sand Springs	West Gate	.....	5.00	5.00	20.65	189.56	210.21	42.04
Churchill	55	2	E	West Gate	East Gate	.....	10.24	10.24	7.02	1,429.53	1,436.55	140.29
Churchill	56	2	F	East Gate	E County Line				.....	5.82	5.82	.....
Lander	57	2	A	W. County Line	Campbell Creek				.....	16.66	16.66	.....
Lander	63	2	B	Campbell Creek	Hay Ranch				.....	14.64	14.64	.....
Lander	61	2	C	Hay Ranch	Smith Creek			.	.....	3.17	3.17	.....
Lander	62	2	D	Smith Creek	Austin			.	.....	3.17	3.17	.....
Eureka	31	2	B	Hay Ranch	Eureka	12.17	8.59	11.56	681.22	1,348.12	2,029.34	b175.55
Eureka		2	C	Eureka	E. County Line			.	.....	20.77	20.77	.....
White Pine		2	A	W. County Line	Pancake			.	.....	52.39	52.39	.....

White Pine	44	2	B	Pancake	Illipah	.....	22.95	22.95	46.43	1,586.27	1,632.70	71.14
White Pine	10	2	C2	Illipah	Robinson Sm't.	.....	15.01	15.01	285.20	1,497.33	1,782.53	118.76
White Pine	6	2	C1	Robinson Sm't.	Keystone	12.46	.....	12.46	236.70	43.21	279.91	22.46
White Pine	25	2	C3	Keystone	Ely	2.00	2.00	4.00	237.16	418.34	655.50	163.87
White Pine	70	2	D	City of Ely				.	.....	102.58	102.58	.....
White Pine		2	D	Ely	McGill	.....	6.00	6.00	.....	204.44	204.44	34.07
White Pine		2	E	McGill	Indian Creek	.....	6.00	6.00	.....	78.86	78.86	13.14
Esmeralda	11	3	C	Goldfield	Tonopah	8.93	.....	8.93	508.28	.....	508.28	56.92
Mineral	23	3	D	Hawthorne	Cottonwood Crk.	1.73	4.00	5.73	91.94	205.87	297.81	51.97
Mineral	23	3	E	Cottonwood Crk.	Schurz	9.33	.....	9.33	1,468.80	6.05	1,474.85	158.08
Lyon	59	3	A1	City of Yerington		.....	1.43	1.43	.....	392.77	392.77	274.66
..	17							.				
Lyon	33	3	B	Yerington	Wilson	12.93	.....	12.93	725.34	59.17	784.51	60.67
Lyon	8	3	C	Wilson	Hudson A. Rd.	7.27	.....	7.27	1,616.94	21.47	1,638.41	225.37
Lyon	12	3	D	Hudson Aurora	W. Co. Line	2.31	.....	2.31	379.01	0.75	379.76	164.40
Douglas	4	3	B1	Holbrook	Carters Station.	4.00	.....	4.00	358.74	.....	358.74	89.68
Douglas	20	3	B2	Carters Sta.	Gardnerville	2.00	.....	2.00	179.77	.....	179.77	89.89
Douglas	28	3	B3	Gardnerville	Minden	1.80	.....	1.80	356.12	3.23	359.35	199.64
Douglas	14	3	C1	Minden	3½ Mi. North	3.45	.....	3.45	227.73	8.07	235.80	68.35
Douglas	38	3	C2	3½ m. N. Minden	North Co. Line.	.....	2.42	2.42	121.73	219.01	340.74	140.80
Ormsby	60	3	C	City of Carson		.....	0.49	0.49	.....	388.94	388.94	793.76
Ormsby	30	3	C	Carson City	Lakeview	3.48	.....	3.48	398.49	49.68	448.17	128.78
..	29							.				
Washoe	7	3	A	Lakeview	Huffakers	19.79	.....	19.79	2.582.22	60.04	2,642.26	133.51
Washoe	9	3	B	Huffakers	Reno	5.42	.....	5.42	613.21	.....	613.21	113.14
Douglas	67	3	D	Cave Rock	Cal. State Line.	.....	2.00	2.00	.....	194.55	194.55	97.27
Nye	2	4	A1	Tonopah	Toiyabe Nat'l. F.	14.75	.....	14.75	390.99	.....	390.99	26.51
Nye	13	4	D	Nyala	Currant	4.50	.....	4.50	178.02	.....	178.02	39.56
..	46							.				
..	39							.				
..	40							.				
Clark & Nye	41	5		Las Vegas	Beatty	85.00	14.85	99.85	50.16	1,479.06	1,529.22	15.32
Clark	42	6	D	Las Vegas	Apex	13.31	7.97	7.97	200.71	1,525.77	1,726.48	b216.62
Clark	37	6	E	Apex	Crystal	.....	19.63	8.26	5.00	2,928.73	2,933.73	b354.32
Clark	43	6	F	Crystal	Mormon Mesa	.....	8.00	8.00	16.21	511.45	527.66	65.96
Clark	52	6	G	Across Mormon M				.	466.32	69.36	c535.68	.....
Clark	53	6	H	Mormon Mesa	State Line			.	.....	1.67	1.67	.....
Lincoln	68	7	D1	Pioche	Stone House	.....	13.51	13.51	.....	1,445.69	1,445.69	107.01
Lincoln	69	7	D2	Pony Springs	Dutch John	.....	9.56	9.56	.....	787.11	787.11	82.33
Humboldt	72	8	A	Winnemucca	Toll House	.....	6.00	6.00	.....	309.65	309.65	51.61
Humboldt	71	8	B	Toll House	Paradise	.....	4.00	4.00	.....	19.35	19.35	4.84
Washoe	36	9	A	Reno	Purdy	15.29	3.76	b15.77	1,173.26	168.37	1,341.63	85.07
						378.46	239.31	580.48	$20,410.45	$30,301.28	$50,711.73	$87.36

* Plans revised for awarding surfacing contract.
a Line revised to decrease length.
b Original plans abandoned, due to re-routing of line.
c Bridge design; no road mileage.

Table Number Eight.

TABLE SHOWING COST PER MILE OF SURVEYS 1917 TO 1922 INCLUSIVE

County.	Project No.	Route.	Section.	FROM	TO	Total miles surveyed.	Miles adopted location surveyed 1917-1920.	Miles adopted location surveyed 1921-1922.	Total miles adopted location.	Cost of surveys, 1917-1920.	Cost of surveys, 1921-1922.	Total cost of surveys.	Cost per mile of adopted location.
..	26												
Washoe	73	1	A	State Line	Reno	24.69	9.95	1.01	10.96	$3,132.16	$5,556.20	$8,688.36	$792.73
Washoe	21	1	B1	Reno	Sparks	0.97	0.97	.....	0.97	103.13	.....	103.13	106.32
Washoe	65	1	B2	Sparks	Vista	2.99	2.99	.....	2.99	317.90	465.06	782.96	261.86
Washoe	48	1	B3	City of Sparks		2.25	.....	1.59	1.59	.....	224.95	224.95	141.48
Washoe	66	1	D	Clark	E. Co. Line	2.15	.....	0.91	0.91	.....	436.09	436.09	479.22
Pershing		1	B	Toulon	Lovelock	3.92	3.92	.....	3.92	50.16	86.87	137.03	34.95
Pershing		1		City of Lovelock						.....	26.15	26.15	.....
Pershing	1	1	C	Lovelock	Zola	16.70	16.70	.....	16.70	1,923.19	62.53	1,985.72	118.91
Pershing	19	1	D	Zola	Mill City	27.81	27.81	.....	27.81	2,483.09	38.93	2,522.02	90.69
Humboldt	58	1	A	S. County Line	Winnemucca	17.20	.....	13.20	13.20	.....	2,599.01	2,599.01	196.89
Humboldt		1	B	Winnemucca	Golconda	21.00	.....	15.13	15.13	.....	2,763.68	2,763.68	182.66
Humboldt		1	C	Golconda	Stone House	16.08	12.08	4.00	16.08	1,504.93	704.15	2,209.08	137.38
..	47												
Humboldt	32	1	D	Stone House	E. County Line	10.84	10.84	.....	10.84	1,199.64	993.12	2,192.76	202.28
Lander	16	1	A	W. County Line	E. County Line	39.73	28.45	.....	28.45	2,651.76	608.54	3,260.30	114.60
Eureka	22	1	A	W. County Line	E. County Line	42.15	27.25	.....	27.25	5,836.79	384.35	6,221.14	228.30
Elko	15	1	A2	W. County Line	Vivian	22.76	8.34	7.16	*7.16	1,157.43	1,002.73	2,160.16	301.70
Elko	5	1	A1	Vivian	Elko	29.97	18.73	.....	18.73	2,599.35	24.68	2,624.03	140.10
Elko		1	B	City of Elko		2.79	.....	0.79	0.79	.....	374.42	374.42	473.95
Elko	18	1	B	Elko	Halleck	29.09	20.56	.....	19.70	2,981.52	669.79	3,651.31	185.35
Elko		1	C	Halleck	Deeth	12.41	.....	12.41	12.41	.....	1,266.14	1,266.14	102.03
Elko	54	1	D	Deeth	Wells	34.64	.....	20.14	20.14	.....	4,318.07	4,318.07	214.40
Elko		1	E	Wells	Tobar	17.93	.....	10.57	10.57	.....	1,806.52	1,806.52	170.91
Lyon	66	2	A	W. County Line	E. County Line	26.51	.....	12.83	12.83	.....	2,929.98	2,929.98	228.37
..	66												
Churchill	34	2	A	W. County Line	Leeteville	17.41	8.29	1.73	10.02	1,493.36	982.77	2,476.13	247.12
Churchill	3	2	B	Leeteville	Fallon	10.04	7.62	.....	7.62	1,150.17	.....	1,150.17	150.94
Churchill	49	2	B	City of Fallon		1.45	.....	1.22	1.22	.....	338.89	338.89	277.78
Churchill	64	2	C3	Fallon	Grimes Ranch	20.39	.....	11.16	11.16	.....	2,778.66	2,778.66	248.98
Churchill	24	2	C1, 2	Grimes Ranch	Sand Springs	22.43	17.03	5.40	22.43	1,587.07	453.07	2,040.14	90.96
Churchill	45	2	D	Sand Springs	West Gate	19.45	11.69	7.76	19.45	1,637.92	256.43	1,894.35	97.40
Churchill	55	2	E	West Gate	East Gate	32.95	11.50	6.35	*10.24	1,653.17	3,333.74	4,986.91	487.00
Churchill	56	2	F	East Gate	E County Line	21.18	.....	14.76	14.76	.....	4,948.99	4,948.99	335.30
Lander	57	2	A	W. County Line	Campbell Creek	3.44	.....	2.72	2.72	.....	691.21	691.21	254.12
Lander	63	2	B	Campbell Creek	Hay Ranch					.....	164.33	164.33	.....
Lander	61	2	C	Hay Ranch	Smith Creek					.....	194.82	194.82	.....
Lander	62	2	D	Smith Creek	Austin					.....	176.48	176.48	.....
Lander		2	F	Forest Bdwy	E. County Line					.....	25.67	25.67	.....
Eureka		2	A	W. County Line	Hay Ranch					.....	23.20	23.20	.....

Eureka	31	2	B	Hay Ranch	Eureka	23.89	12.17	8.59	*11.56	903.04	871.96	1,775.00	153.55
Eureka		2	C	Eureka	E. County Line					.....	19.51	19.51	.....
White Pine		2	A	W. County Line	Pancake					.....	16.71	16.71	.....
White Pine	44	2	B	Pancake	Illipah	23.00	22.95	.....	22.95	2,885.81	339.71	3,225.52	140.55
White Pine	10	2	C2	Illipah	Robinson Sm't.	17.21	15.01	.....	15.01	2,290.50	527.95	2,818.45	187.77
White Pine	6	2	C1	Robinson Smt	Keystone	14.28	12.46	.....	12.46	1,901.40	12.75	1,914.15	153.63
White Pine	25	2	C3	Keystone	Ely	6.74	5.88	.....	5.88	1,217.99	.....	1,217.99	207.14
White Pine	70	2	D	City of Ely		2.00	.....	2.00	2.00	.....	37.95	37.95	18.97
White Pine		2	D	Ely	McGill	13.08	12.69	.....	12.69	1,984.39	12.82	1,997.21	157.39
White Pine		2	E	McGill	Indian Creek	17.65	17.65	.....	17.65	835.96	.....	835.96	47.36
White Pine		2	F	Indian Creek	Shellbourne	9.50	9.50	.....	9.50	650.17	.....	650.17	68.44
Esmeralda	11	3	C	Goldfield	Tonopah	23.22	23.20	.....	23.20	1,199.32	176.69	1,376.01	59.39
Mineral	23	3	D	Hawthorne	Cottonwood Crk.	14.52	12.99	.....	12.99	1,013.57	26.90	1,040.47	80.10
Mineral	23	3	E	Cottonwood Crk.	Schurz	26.96	9.33	.....	9.33	10,236.87	61.13	10,298.00	1,103.75
Lyon	59	3	A1	City of Yerington		1.43	.....	1.43	1.43	.....	421.19	421.19	294.54
	17												
Lyon	33	3	B	Yerington	Wilson	20.18	12.93	.....	12.93	2,137.29	143.76	2,281.05	176.42
Lyon	8	3	C	Wilson	Hudson A. Rd.	21.01	7.27	.....	7.27	3,217.54	299.76	3,517.30	483.81
Lyon	12	3	D	Hudson Aurora	W. Co. Line	7.96	4.69	.....	4.69	1,038.43	4.50	1,042.93	222.37
Douglas		3	A	E. Co. Line	Walker R Bridge	4.72	4.72	.....	4.72	1,327.77	265.05	1,592.82	337.36
Douglas	4	3	B1	Holbrook	Carters Station	7.43	7.01	.....	7.01	956.28	.....	956.28	136.42
Douglas	20	3	B2	Carters	Gardnerville	13.21	11.48	.....	11.48	706.14	.....	706.14	61.51
Douglas	28	3	B3	Gardnerville	Minden	2.16	1.80	.....	1.80	584.80	5.00	589.80	327.67
Douglas	14	3	C1	Minden	3½ Mi. North	3.45	3.45	.....	3.45	686.55	56.55	743.10	215.39
Douglas	38	3	C2	3½ m. N. Minden	North Co. Line	13.80	8.15	.....	8.15	1,272.29	1,301.30	2,573.59	315.78
Ormsby		3	A	S. Co. Line	Carson City	3.12	3.12	.....	3.12	216.94	.....	216.94	69.53
Ormsby	60	3	C	City of Carson		0.49	.....	0.49	0.49	.....	158.83	158.83	324.14
Ormsby	30	3	C	Carson City	Lakeview	11.29	3.48	.....	3.48	886.86	125.17	1,012.03	290.81
	29												
Washoe	7	3	A	Lakeview	Huffakers	50.75	19.79	.....	19.79	8,054.69	150.82	8,205.51	414.63
Washoe	9	3	B	Huffakers	Reno	7.95	5.42	.....	5.42	982.95	66.60	1,049.55	193.64
Douglas	67	3	D	Cave Rock	Cal. State Line	14.80	.....	7.40	7.40	.....	5,484.16	5,484.16	741.10
Nye	2	4	A1	Tonopah	Toiyabe Nat'l. F.	17.73	14.75	.....	14.75	1,189.82	.....	1,189.82	80.67
Nye	13	4	D	Nyala	Currant	41.56	39.00	.....	39.00	4,064.88	27.25	4,092.13	104.93
	46												
	39												
	40												
Clark & Nye	41	5		Las Vegas	Beatty	118.00	118.00	.....	118.00	1,186.35	4,719.58	5,905.93	50.50
Clark		6	B	Jean	Erie					.....	118.50	118.50	.....
Clark	42	6	D	Las Vegas	Apex	31.20	13.31	17.33	*17.33	813.52	3,162.09	3,975.61	229.41
Clark	37	6	E	Apex	Crystal	63.61	40.51	14.58	*14.58	8,296.75	13,424.53	21,721.28	1,489.80
Clark	43	6	F	Crystal	Mormon Mesa	36.51	16.51	20.00	*20.00	4,376.53	4,672.92	9,049.45	452.47
Clark	52	6	G	Across Mormon Mesa		24.19	6.19	18.00	*18.00	2,228.06	4,000.94	6,229.00	346.06
Clark	53	6	H	Mormon Mesa	State Line	5.00	.....	5.00	5.00	.....	1,027.91	1,027.91	205.58
Lincoln	68	7	D1	Pioche	Stone House	15.81	.....	13.51	13.51	.....	2,360.66	2,360.66	174.74
Lincoln	69	7	D2	Pony Springs	Dutch John	9.56	.....	9.56	9.56	.....	891.72	891.72	93.28
Humboldt	72	8	A	Winnemucca	Toll House	26.47	.....	11.81	11.81	.....	2,335.21	2,335.21	197.73
Humboldt	71	8	B	Toll House	Paradise	13.70	.....	12.25	12.25	.....	2,751.88	2,751.88	224.64
Washoe	36	9	A	Reno	Purdy	21.36	15.29	3.76	*15.77	1,765.40	543.60	2,309.00	146.42
Clark		7	A	Moapa	No. Co. Line					.....	1,271.32	1,271.32	.....
						a 1,353.82	755.42	296.55	946.16	$104,571.60	$93,605.10	$198,176.70	$209.45

* Original survey abandoned, due to re-routing of line.
a Average cost per mile of line surveyed, $146.38.

Table Number Nine.

SEGREGATION OF MAINTENANCE EXPENDITURES

COUNTY	1921	1922	Grand Total
Churchill	$ 5,562.19	$19,102.07	$24,664.26
Clark	1,233.52	980.70	2,214.22
Douglas	982.09	5,108.31	6,090.40
Elko		850.32	850.32
Esmeralda	2,507.83	2,988.98	5,496.81
Eureka		837.34	837.34
Lander	118.29		118.29
Lyon	6,392.60	4,318.21	10,710.81
Mineral	660.20	3,314.75	3,974.95
Nye	3,551.65	3,108.24	3,659.89
Ormsby	376.55	922.42	1,298.97
Pershing	1,386.20	4,338.41	5,724.61
Washoe	10,661.89	15,158.89	25,820.78
White Pine	168.25	968.91	1,137.16
Totals	$33,601.26	$61,997.55	$92,598.81

Table Number Four.

LAHONTAN PLANT CONSTRUCTION

Items of Cost	DISTRIBUTION		Grand Total
	Plant Construction	Spur Track Construction	
Plans and design	$ 796.24		
Supervision	803.96		
Materials	40,951.48		
Supplies	3,509.16		
Labor—Direct	14,740.73		
Labor—Indirect—Boarding House	5,817.86		
Machinery and equipment	2,692.46		
Spur track		19,618.22	
	$69,311.89	$19,618.22	$88,930.11
Depreciation written off			67,137.00
Inventory value of plant			$21,807.11

LAHONTAN PLANT OPERATION

Operating Items	Operation	Maintenance	
Labor—Direct	$30,862.93	$12,517.85	
Labor—Indirect—Boarding House	17,198.09		
Fuel and power	21,556.41		
Materials	2,895.77		
Supplies	2,994.68	14,049.93	
Miscellaneous	9,265.10	1,791.81	
	$84,518.12	$28,359.59	$112,877.71

Table Number Eleven.

LAHONTAN PLANT OUTPUT AND PRODUCTION COST ALLOCATION

Cont. No.	Location.	County.	Tons of Gravel.	Tons of Sand.	Total Output.	Value Charged.
12	Reno-Huffakers	Washoe	5,082.15	3,889.61	8,971.76	$18,162.92
28	Huffakers-Washoe Summit	Washoe	13,242.28	10,299.08	23,541.36	43,493.45
29	Washoe Summit-Bowers	Washoe	7,293.75	6,954.92	14,248.67	27,935.96
31	Evans Creek Bridge	Washoe	287.50	140.40	427.90	865.92
36	Minden-Gardnerville	Douglas	2,010.55	2,791.00	4,801.55	9,716.65
37	Bowers-Lakeview	Washoe	80.55	101.95	182.50	369.31
38	Bowers-Lakeview	Washoe	271.52	210.05	481.57	914.11
39	Minden-Carson City	Douglas	90.30		90.30	150.26
42	Bowers-Lakeview	Washoe	1,460.65	4,250.00	5,710.65	10,623.87
48	Hazen-Leeteville	Churchill	439.27	170.94	610.21	911.19
51	Carson-Lakeview	Ormsby	857.71	5,784.86	6,642.57	10,965.36
62	City of Yerington	Lyon	3,675.86	1,929.83	5,605.69	8,464.29
	Cradlebaughs	Douglas	215.45	71.75	287.20	433.66
CA 19	Reno-Lawtons	Washoe	56.60	2,048.70	2,105.30	3,879.48
CA 51	Reno-Lawtons	Washoe	616.95	908.00	1,524.95	2,271.40
CA 52	Reno-Lawtons	Washoe	1,329.59	2,000.04	3,329.63	4,951.67
CA 53	Reno-Lawtons	Washoe	1,538.17	2,410.79	3,948.96	5,873.66
CA 61	Sparks-Vista	Washoe	767.86	2,806.61	3,574.47	5,315.79
CA 62	Sparks-Vista	Washoe	2,608.83	741.87	3,350.70	4,988.73
CA 64	Sparks-Vista	Washoe	691.75	1,506.33	2,198.08	3,290.29
CA 70	City of Fallon	Churchill	293.96	710.70	1,004.66	1,516.98
CA 71	Lahontan Sand Stock Pile			6,548.00	6,548.00	9,887.08
	Maintenance					
	Reno-Huffakers	Washoe	158.85		158.85	301.24
	Nevada State Prison		502.20	995.80	1,498.00	2,852.62
	U. S. Reclamation Service		500.00	240.00	740.00	1,327.42
	Nevada Fish Commission		109.77	57.72	167.49	249.08
	Nevada Valleys Power Co.		48.20	38.00	86.20	154.60
	Baker Bros.			79.05	79.05	119.36
		TOTALS	44,230.27	57,686.00	101.916.27	$179,986.35

Average cost per ton 1.76602

Table Number Twelve.

TRAFFIC RECORD

HIGHWAY Total days	1	2	3	4	5	6	7	1922 Grand Total	1917 Total	1920 Total	Per-Cent Increase	1921 Total	Per-Cent Increase	1922 Total	Per-Cent Increase	Daily Average
A. Reno-Carson at Moana Road—Aug. 30 to Sept. 5, inc.																
Total vehicles	1023	1040	978	1189	2134	1569	954	8887	3038	5141	69	7025	66	8887	27	1270
Trucks	48	62	50	71	46	53	72	402	....	....	..	....	..	....	...	57
Foreign Cars	60	62	67	78	180	96	99	642	....	....	..	....	..	....	.....	92
B. Minden-Gardnerville, Midway—Sept. 7 to Sept. 13, inc.																
Total vehicles	710	758	766	735	750	724	805	5248	....	....	..	....	..	....	...	750
Trucks	84	78	107	68	114	32	87	620	....	....	..	....	..	....	...	89
Foreign Cars	55	59	42	47	42	52	62	359	....	....	..	....	..	....	...	51
C. Reno-Sparks, Midway—Sept. 15 to Sept. 21, inc.																
Total vehicles	1652	1474	1869	1634	1534	1526	1690	11379	....	....	..	....	..	....	...	1626
Trucks	131	103	47	106	98	87	86	658	....	....	..	....	..	....	...	94
Foreign Cars	110	75	59	108	95	71	92	610	....	....	..	....	..	....	...	87
D. South of Yerington, 1 mile—Aug. 4 to Aug. 7, inc.																
Total vehicles	350	402	350	434	....	....	....	1536	....	....	..	....	..	....	...	384
E. West of Fallon, 1 mile—July 28 to July 31, inc.																
Total vehicles	232	264	292	266	....	....	....	1054	...	....	..	....	..	....	...	263
Foreign Cars	14	15	14	10	....	....	....	53	....	....	..	....	..	....	...	13
F. North of Lovelock, 1 mile—July 28 to July 31, inc.																
Total vehicles	90	74	100	92	....	....	....	356	....	....	..	....	..	....	...	89
G. West Walker Lake Highway, Midway—Aug. 1 to Aug. 6, inc.																
Total vehicles	17	16	19	12	18	25	....	107	....	....	..	....	..	....	...	18
H. East of Las Vegas, 7 miles—Dec. 9 to Dec. 15, inc.																
Total vehicles	67	78	49	61	51	64	38	408	....	....	..	....	..	....	..	58
Trucks	17	7	8	11	9	5	7	64	....	....	..	....	..	....	..	9
Foreign Cars	60	41	26	33	31	46	35	272	....	....	..	....	..	....	...	39

TRUCK-TRAFFIC CENSUS

POINT OF CENSUS	Total Days	1	2	3	4	5	6	7	Total	Daily Average
Reno-Carson City	1-ton Trucks	30	39	34	40	37	45	46	271	38
	2-ton Trucks	9	6	8	7	4	7	10	51	7
	3-ton Trucks	4	5	3	9	2	0	8	31	4
	5-ton Trucks	5	12	5	15	3	1	8	49	7
	Subtotals	48	62	50	71	46	53	72	402	49
Reno-Sparks	1-ton Trucks	68	53	24	55	57	43	46	346	49
	2-ton Trucks	29	20	10	28	20	30	27	164	23
	3-ton Trucks	13	22	10	13	11	9	8	86	12
	5-ton Trucks	21	8	3	10	10	5	5	62	9
	Subtotals	131	103	47	106	98	87	86	658	94
Minden-Gardnerville	1-ton Trucks	33	30	51	31	39	34	35	253	36
	2-ton Trucks	11	12	15	5	24	11	14	92	13
	3-ton Trucks	10	10	13	9	17	15	17	91	13
	5-ton Trucks	30	26	28	23	34	22	21	184	26
	Subtotals	84	78	107	68	114	82	87	620	88

Table Number Thirteen.

TABLE SHOWING MOTOR VEHICLE LICENSE INCOME AND USE OF SAME

Year.	Amount.	Automobile Road fund.	State Highway fund.	Motor Vehicle License Exp. fund.	Auto road Repair fund.	State Highway Bond Int. and Redem. fund.	Consolidated Bond Int. and Rdem. fund.
1913	$3,322.94	$3,322.94					
1914	4,331.08	4,331.08					
1915	7,297.61	7,297.61					
1916	17,721.85	17,721.85					
1917	27,854.65	.....	$22,583.15	$3,332.00	$1,939.50		
1918	34,945.60	.....	28,414.60	4,364.00	2,167.00		
1919	37,110.50	.....	30,738.25	4,661.50	1,710.75		
1920	103,758.58	.....	329.75	5,559.50	2,116.31	$95,753.02	
1921	102,410.32	.....	.....	5,557.00	1,540.85	90,151.55	$5,160.92
1922	120,937.73	.....	.....	6,269.39	2,066.25	.....	112,602.09
Totals	$459,690.86	$32,673.48	$82,065.75	$29,743.39	$11,540.66	$185.904.57	$117,763.01

Table Number Fourteen.

TABLE SHOWING SALE AND REDEMPTION OF STATE HIGHWAY BONDS

Number of bonds.	Date issued.	Amount.	Amount Redeemed.
1- 200 inclusive	March 5, 1920	$100,000.00	$100,000.00
201- 400 inclusive	May 5, 1920	100,000.00	100,000.00
401- 600 inclusive	August 21, 1920	100,000.00	
601- 700 inclusive	August 21, 1920	50,000.00	
701- 950 inclusive	October 30, 1920	125,000.00	
951-1050 inclusive	December 3, 1920	50,000.00	50,000.00
1051-1200 inclusive	December 16, 1920	75,000.00	
1201-1440 inclusive	April 28, 1921	120,000.00	
1441-1600 inclusive	September 17, 1921	80,000.00	
		$800,000.00	$250,000.00

Table Number Seventeen.

BOND INTEREST AND REDEMPTION

Year.	Total Receipts.	Interest on bonds.	Bonds Redeemed.	Balance in fund.
1920	$95,753.02	$654.15	$90,000.00	
1921	95,312.47	29,126.99	100,000.00	
1922	112,602.09	17,920.48	60,000.00	
Totals	$303,667.58	$47,701.62	$250,000.00	$5,965.96

Table Number Eighteen.

Opening The Doors Of Opportunity

Each Mile of Completed Highway Adds Just So Much To The Social and Industrial Development of Our Commonwealth

By HOWARD M. LOY
Assistant Highway Engineer

CONSTRUCTION PROGRESS

HOWARD M. LOY

Assistant State Highway Engineer

Division Engineers—Div. 1 C. C. Boyer, Div. 2 E. T. Hinshaw, Div. 3 S. C. Durkee.

DIVISION OFFICES

In order to facilitate the handling of construction work and negotiations with the various Boards of County Commissioners, the State has been divided into three districts or divisions with a Division Engineer in charge of each.

Division 1 comprises Nye, Clark and Lincoln Counties. The division office is in the County Court House, Las Vegas.

Division 2 comprises Washoe, Pershing, Churchill, Lyon, Douglas, Ormsby, Storey, Mineral and Esmeralda Counties. The division office is in the Gazette Building, Reno.

Division 3 comprises Elko, White Pine, Eureka, Lander and Humboldt Counties. The division office is in the Hesson Building, Elko.

CONSTRUCTION POLICY

A highway may properly be divided into two parts, first the road bed comprising the material in embankments and removed from cuts to form the graded highway, together with culverts, drainage ditches, etc., which assure the permanence of the road bed, and second any surfacing or pavement which is placed upon the roadbed to enable it to sustain the traffic and provide easier riding qualities for the highway.

The factors affecting the design and construction of the road bed are local topography, climate and soil conditions. These conditions will not materially vary as time goes on, except that improvement of lands adjacent to the highway may somewhat change drainage conditions. If, then, the roadbed is designed and constructed to meet present conditions and the materials used in culvert construction are known to have a long life, the roadbed may be considered as practically permanent.

In the design and construction of a surface or pavement an additional factor must be considered. This factor is the probable future traffic which the highway will carry and it cannot be definitely predetermined but must be estimated. Some of the natural soil roads of this State which four years ago carried the traffic and remained in good condition with little or no maintenance are today breaking down under the increased traffic and yet the present travel probably does not exceed one hundred vehicles per day.

With these principles in mind, the Department adopted the policy of constructing the roadbed with extreme care using only concrete or carefully tested galvanized metal for culverts; and of constructing a surface sufficient for the traffic of the present and immediate future which surface could later be easily and economically thickened by placing thereon an additional course of the same or a higher type material.

Plate Number Four.

The minimum width of roadbed being constructed is 20 feet, while on most projects a minimum width of 21 feet is being used and culverts are being constructed to provide for future widening to 24 feet. A single track surfacing 10 feet wide is being constructed on most projects. On embankments, where the natural soil shoulders will not sustain passing traffic, turnouts are constructed about 2000 feet apart so as to provide an eighteen foot surface for passing vehicles. When the traffic becomes heavy enough to warrant a double track surface, the width of surfacing can be increased to fifteen or eighteen feet.

GRAVEL SURFACED ROADS

When material is available locally, the cheapest surface to construct is one of gravel. Such a surface, when properly constructed, can be maintained economically and as cheaply as surfaces of higher types provided the traffic does not exceed about 400 vehicles per day.

The contract cost per square yard for gravel surface on eighteen projects contracted in 1922 varied from 29 cents to 85 cents, the wide variation being due principally to the difference in length of haul for the material and the ease or difficulty with which it could be secured from the pit. On four contracts the cost was more than 60 cents per sq. yd., on two less than 40 cents per sq. yd., on eight between 40 and 50 cents and on four between 50 and 60 cents per sq. yd. The average contract cost for all projects was 50 cents per sq. yd.

The approximate costs of other types of surface are as follows:

Asphalt Macadam	6 inches thick	$2.00 per sq. yd.
Asphaltic Concrete	6 inches thick	2.75 per sq. yd.
Portland Cement Concrete	6 inches thick	2.85 per sq. yd.

It is apparent from these figures that, unless gravel cannot be secured within a reasonable distance of the project or a large traffic is anticipated in the near future, the economical surface to construct is one of gravel. Furthermore, a large part of the State Highway System lies in territory where it would be impracticable to construct a "hard surface" without first building a gravel or rock sub-base which would add approximately the cost of a gravel surface to the above costs for higher types. This condition prevails in nearly all of the valley bottoms, such as the Humboldt and Reese River Valleys. This same soil is inadequate to carry the traffic that now uses the roads and therefore a surface of some kind must be provided at the time the grading is done. A good gravel surface constructed at this time becomes the base for a higher type surface in the future when the increased traffic requires such a surface.

Surfaces of mine waste, decomposed granite, shale, or crushed rock are considered as included under the heading of Gravel Surface. Although the cost of a crushed rock surface will usually be more than one of gravel, in some cases ledge or float rock may occur in the vicinity of the project while gravel could be secured only by an almost prohibitory haul.

Prior to 1921, gravel surfaces were constructed of material grading downward from a maximum size of 2 1-2 inches. This size was used because it fitted the available deposits in the State and also conformed to standard practice in other parts of the country. It was found that the larger particles in a surface so constructed continually worked to the surface and were then torn loose causing the formation of holes and adding greatly to the cost of maintenance. Consequently, the maximum size of the material used has been reduced to 1 inch and the grading and proportioning is being carefully watched so as to secure a uniform material. We note that other states are reducing the maximum size of their material evidently for the same reasons.

It has been satisfactorily demonstrated by this year's construction that the use of a 1 inch maximum size gravel is giving a surface which compacts and binds much better and on which the maintenance will be much less than on the surfaces using a larger material.

It is evident that a much larger percentage of the pit or deposit must be rejected when the maximum size allowed is 1 inch instead of 2 1-2 inches and yet the average cost per square yard for gravel surface was actually less in 1922 than in 1920. This is due to lower costs for labor and materials and to the fact that the contracts were awarded this year on the cubic yard and yard mile haul basis. That is, the contractor receives a definite price for each mile over which a cubic yard of gravel is hauled in carrying it from the pit to the road. Under the specifications previously used, the contractor bid a price per square yard for the surface complete in place regardless of the haul. He naturally increased his bid to cover the contingency of an unanticipated increase in the haul distance and the State paid the increased price whether or not there was an increased haul.

Our effort to remove some of the gamble in highway contracting has borne fruit in dollars saved to the State.

ASPHALTIC WEARING SURFACES

As traffic increases beyond a certain point, the maintenance cost on gravel roads mounts rapidly. Some of our projects have reached this stage and it will be necessary to place an additional surface of some kind upon these projects at an early date. In order to ascertain the most economical wearing surface for graveled roads, the State and Federal Governments placed six different types of asphaltic wearing surfaces on Project 14 which extends from Minden to a point 3.45 miles north. The types placed varied in thickness, method of construction, and the grade of asphalt used. The least expensive type is 3-4 of an inch thick composed of gravel and road oil containing 75 per cent asphalt. The most expensive type is 3 to 3 1-2 inches thick placed in two courses and composed of gravel and heavy asphalt applied hot. Insufficient time has elapsed since placing these surfaces for making comparisons and reaching conclusions but it is expected that from this experiment we will be able to develop an economical wearing surface to be applied on our gravel roads when necessary.

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